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ABSTRACT

This document provides descriptive profiles of the current and past supply of health manpower and projections of manpower supply to 1990. It presents detailed descriptions of the methodology and techniques used to derive the profiles and projections, and provides interpretations and evaluations of the adequacy and comparability of existing statistics, with descriptions of the more conspicuous gaps in the current health manpower information system. The health manpower occupations covered are the major health professional categories, including a number of specialities within these categories, and selected groups of allied health professions and occupations. The report was developed to provide a wide range of users of health manpower statistics with a comprehensive reference compendium of basic information on major health occupations. It was prepared in 1972 and 1973 as part of a major manpower study within the Bureau of Health Resources Development. The chapters are divided into two main parts. The first part provides an overview of the concepts, methodology, and assumptions underlying the estimates and projections. It also presents summary highlights of the study in both tabular and narrative form. The second part presents detailed statistical material on the current manpower profile and projected supply in specific health fields. These two parts are followed by appendixes that include detailed projection tables presenting information not shown separately in individual chapters. (Author/KE)

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HEALTH
MANPOWER
REFERENCES

The Supply Of Health Manpower

1970 PROFILES AND PROJECTIONS TO 1990

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FOREWORD

This report provides descriptive profiles of the current and past supply of health manpower and projections of manpower supply to 1990. It presents detailed descriptions of the methodology and techniques used to derive the profiles and projections, and provides interpretations and evaluations of the adequacy and comparability of existing statistics, with descriptions of the more conspicuous gaps in the current health manpower information system. The health manpower occupations covered are the major health professional categories, including a number of specialties within these categories, and selected groups of allied health professions and occupations.

The report was developed to provide a wide range of users of health manpower statistics with a comprehensive reference compendium of basic information on major health occupations. It was prepared in 1972 and 1973 as part of a major manpower study within the Bureau of Health Resources Development (then the Bureau of Health Manpower Education). This broader effort, termed "Project SOAR" (Supply, Output, and Requirements), was primarily designed to provide baseline supply and requirements information useful to the Federal Government in the development of optional strategies and policies concerning the Nation's health manpower production and health care delivery systems. The product of the initial phase of this broader effort is presented in the report that follows.

This report is a first step and is not considered or offered as the final word in manpower supply analysis and projection methodology. It has many limitations, stemming partly from the lack of an adequate data base, partly from the lack of a fully developed methodology. Despite these limitations, which are made as explicit as possible in the report, the consensus of reviewers both inside and outside the Government was that it represents an advance in the state-of-the-art and the best available single source of manpower supply data, primarily because of the use of stated and verifiable methods. As such, it was deemed of value both to the Nation's research and analysis community and to all those who are involved in making decisions that affect the future supply of health manpower.

The work reported herein was initiated in the Division of Manpower Intelligence, which was a component of the Bureau of Health Resources Development until March 1, 1974, when it was dissolved in conjunction with reorganization of the Bureau. The report was prepared under the direction of Howard V. Stambler, Assistant Director of DMI for Manpower and Program Analysis. Paul Schwab, head of the Occupational Analysis Section of DMI, coordinated and supervised the preparation of the report. Other professional staff of the Section who contributed were: Mary C. McGuire, Stuart Bernstein, Pamela C. Roddy, Robert M. Politzer, Alan H. Simmons, Robert C. Hambleton, James S. Morrow, James M. Cultice, Barbara Deroba, Alice W. Walton, Stephen Cohen, Michael Addis, and Joanne Panza. Sections of the report were also prepared by James N. Ake and Jerald B. McClendon of the Bureau's Division of Dental Health, Dr. Merrill Packer, Acting Director; and Helen H. Hudson of the Division of Nursing, Jessie M. Scott, Director. Special thanks go to Grace T. Snyder, Robin A. Imber, Ruth E. Kent, and Tilman W. Steen, who typed and retyped the report in its various draft stages; to Anna E. Gatling, who assembled the report for final copy; and to Harold J. King, who undertook data processing activities related to development of the report.

INTRODUCTION

In 1972, the then Bureau of Health Manpower Education (BHME) asked its Division of Manpower Intelligence (DMI) to assume primary responsibility for providing information and analyses that could be used in developing alternative strategies for the education of health manpower. This overall effort, termed Project SOAR (Supply, Output, and Requirements), was designed as a multiphased systematic analysis of the Nation's health manpower situation today and as it might be in the years ahead, under clearly specified assumptions. The effort was timed so that its results could be used as an analytic input for deliberations likely to be engendered by the expiration in June 1974 of several major health manpower legislative authorizations. Thus SOAR was viewed as an integrating and synthesizing analysis, with primary reliance placed on "best use" of available data and knowledge, supplemented with short-term new analyses that could be accomplished within the time-frame established.

The design of the overall SOAR effort reflects a sequential logic in which outputs of early phases are to be utilized in later stages, but study activities for all phases can be undertaken concurrently. This structure, in addition, allows the development of "free-standing" reports of studies completed during the overall process, so that data and analytic outputs can be used for a variety of purposes apart from the SOAR effort itself. Consequently, the report that follows, although representing the output of the first phase of Project SOAR, has been developed as an independent document for wider distribution. During the preliminary stages in developing this supply report, a number of reviewers in both the public and private sectors encouraged publication of the material to a wide audience of potential users. Their interest focused largely on providing to health manpower planners and analysts the following analysis of the past and current manpower scene, the projections of manpower supply, the assumptions underlying the projections, and detailed description of methodology used, including the inherent limitations of the techniques and their corresponding implications.

The Bureau of Health Resources Development (BHRD) has incorporated the SOAR activities into its ongoing work program. The manpower information and supply projections presented in this report are to be revised and updated periodically as new data and research results become available and as new developments emerge on the national health scene. Furthermore, the analytical efforts that served as the basis for this report highlighted significant information gaps in available data and existing knowledge, thereby providing valuable insights concerning longer-range data collection, analysis, and research efforts that might be needed to better understand the dynamics of health manpower and to improve future estimates of manpower supply.

Major efforts are now under way within the Health Resources Administration (HRA) and other parts of the Department of Health, Education, and Welfare (DHEW) to improve the data base and to utilize new and more sophisticated analytical and other techniques for projection purposes. It is expected that these efforts, coupled with the continuing flow of research results from a number of current studies, will provide the means of filling some of the glaring gaps in the existing information system that are highlighted in this document.

In order that the reader may understand and utilize more effectively the findings of this report, a discussion of the various phases of the SOAR effort seems in order. The first two phases of the project involved the development of a series of baseline supply projections of health manpower to 1990, which are presented in this report, and baseline requirements forecasts, which are being planned for separate publication. These efforts were aimed at providing estimates of future supply and requirements conditions given present experience, the continuation of experiences of recent years, and any future changes already known. Thus, they represent relatively straightforward "if-then" statements, resulting in a heuristic profile of the future rather than an actual prediction of a most likely situation. The first two phases, therefore, represent initial efforts to provide decisionmakers and planners with rationally derived data for formulating policy decisions, legislative proposals, and program options, and to improve the state-of-the-art and methodology of manpower analysis and data.

The third phase, called the contingency phase, consists of forecasts of health manpower requirements based on the assumed effects of a number of major new health care developments on future manpower utilization and productivity—those developments that represent significant departures from historical trends. In this phase—also now nearing completion—several analytic studies have been undertaken as part of BHRD's extramural program to examine the potential derivative impact on manpower requirements of a variety of possible developments in the health service sector, such as changes in health care financing (e.g., national health insurance) and in patterns of health care delivery organization (e.g., spread of health maintenance organizations), as well as the expanded use of task delegation and the possible future impact of technological advances. The end product of this phase will be a broad "fan" of alternative requirements forecasts, built upon adjustments of the earlier baseline requirements projections

and clearly reflecting defined assumptions about the potential interactive impact of various combinations of the major developments under study.

In logical progression, the fourth phase of SOAR consists of an analysis of the comparability of supply and requirements profiles developed earlier. The end product will be a "fan" of supply projections built upon adjustments in the Phase I baseline projections, which reflects potential supply responses under clearly defined sets of assumptions about the demand for health manpower (Phase III output) and other major supply influences; e.g., size and characteristics of foreign medical graduate additions to physician supply. Specific emphasis will be given to apparent disjunctions in supply and requirements, particularly those that might indicate a manpower oversupply, in order to facilitate the formulation of goals with respect to the manpower production system. It should be emphasized here that the supply and requirements estimates developed and examined will not comprise a single set of figures but rather will include a broad range of alternatives. Disjunctions among all combinations of projections are being studied.

The last two phases of Project SOAR are concerned first with defining the specific kinds of manpower production goals that might be suggested by the profile matching of adjusted baseline supply projections with the requirements forecasts and, second, with delineating a number of issues such as the financial viability of medical schools and physician specialty and geographic maldistribution, which do not stem directly from goal definition but rather emanate from other viewpoints and analyses of the health care production system. Education and training system goals (in terms of manpower output, type, and quantity) will then be formulated by examining and evaluating disjunctions in the supply and requirements profiles. Goals will be defined so as to minimize risks of overproduction (particularly in long-lead time and costly production categories) and of shortages in critical service delivery functions.

This discussion of the overall Project SOAR effort should serve to illustrate two key points to the reader:

1. This report represents the output of the first baseline phase of a complex, interactive set of analytic activities, and

2. The nature of the report reflects the particular emphasis and direction utilized to meet the information needs of that phase.

It is also important to note here that the projections presented in the following chapters are in no manner to be viewed by the reader as "official" DHEW, HRA, or BHRD estimates. The projections developed for health manpower supply, as explained later in more detail, are based largely on one critical assumption regarding the future productive capacity of educational institutions to attract and subsequently graduate students. Simply stated, this assumption is that the health manpower production system will receive such future support, whether from Federal or other sources, as is needed to maintain and operate the production system at its 1974-75 output capacity level as a minimum. Consequently, the "reality" of these supply projections for the coming years must be viewed in the context of the actual political and financial setting existing at that time. Such a caveat, obviously, holds true in general terms for any assumptions advanced for these or any other set of projections. As approaches, objectives, and assumptions change to meet different purposes, so do the resulting projections. It is also true that for different policy purposes, different projections would be required. Thus, it is inappropriate to use or to view the projections in this report as "official" estimates of any kind.

The text of the report treats in detail the conceptual framework and the assumptions and projection methodologies utilized, in terms of both their strengths and their limitations. It is important, however, to identify and summarize here a few of the more salient parameters of the report which are indicated or implied above.

1. The 1970 data base utilized is neither comprehensive nor uniform. While the report does contain some new data and analyses not previously presented, it largely represents reassessment and analysis of available data, using as consistent a set of data standards as possible. Where available, more current data are presented in the report.
2. Beyond attempting to use comparable and consistent methodologies, the projections presented are based on the key assumption mentioned earlier: that no additional Federal financial support beyond that authorized by legislation in force through fiscal year 1974 would be available for increasing the output capacity of the health manpower system. That is, the projections assume no further direct Federal support for construction or other financial inducements to increase the enrollment capacity of the Nation's health education and training institutions beyond those efforts already programmed. A corollary implicit assumption is that the health manpower production system will receive future support from the Federal Government or other sources, that will be required to maintain and operate the system at its output capacity.
3. Even within the basic assumption specified in 2. above, several alternative assumptions are possible with respect to production system operations and output capacity. Where appropriate, these assumptions are made as explicit as possible and alternative projections are made when feasible.

4. As a part of the baseline concept, the report is not concerned with changes in projected supply that might be forecast as a result of possible major future changes in manpower demand. Nor does it consider changes in the nature and magnitude of health manpower production system outputs that might be brought about by future Federal involvements addressed to specific problems and issues; e.g., specialty distribution output. In effect, then, the projections—*not* predictions—are intended to indicate what the likely future supply would be if the health manpower system, particularly the production system, continues to operate in the general direction in which it now appears to be headed. Subsequent efforts (not presented in this report) will be focused on changes in the supply projections which might be forecast as the result of changed demand factors and possible changes in the Federal involvement in the manpower production system.

The following chapters are divided into two main parts. The first part provides an overview of the concepts, methodology, and assumptions underlying the estimates and projections. It also presents summary highlights of the study in both tabular and narrative form. The second part presents detailed statistical material on the current manpower profile and projected supply in specific health fields. These two parts are followed by appendixes which include detailed projection tables presenting information on an individual year basis, as well as other relevant information not shown separately in individual chapters. It should be noted that the detail of narratives presented in various sections of this report represents an explicit effort to outline fully the assumptions and methodologies used in developing the projections. In addition, an attempt has been made to provide readers with meaningful background information in order to enhance their understanding of the projections.

As noted in the Foreword, the various chapters of the report were prepared by different groups of specialists. Moreover, since it is believed that individual chapters will be consulted by different groups of readers, it is necessary to repeat explanations of basic assumptions and methodology as applied in projections for each field. Both of these facts serve to explain apparent duplications of material within the chapters that follow.

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PART I
AN OVERVIEW

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Chapter 1 • CONCEPTS, DEFINITIONS, ASSUMPTIONS, AND METHODOLOGY

Over the years, statistics on health manpower have been collected by a number of different organizations for a variety of purposes. Yet no comprehensive and comparable data system on all types of health manpower has been developed. As a consequence, differences in definitions, coverage, timing, and data collection methods have given rise to numerous problems of noncomparability among the statistics. The discussion of the estimates of manpower supply presented in this report—current, historical, and projected—describe not only some of the comparability problems but also the essential weakness of much of the data. In recognition of these problems, an effort has been undertaken here to minimize the more glaring inconsistencies among the estimates of current supply, such as the absence of common reference periods, and to provide a more consistent and manageable framework for analysis.

This chapter describes in general terms the conceptual framework of the statistics presented in this report and explains the guidelines developed to obtain improved consistency in the estimates, including the rationale underlying the definitions, concepts, and techniques used. Also discussed are a number of comparability problems which still remain and their significance in any evaluation of the data. The remainder of the chapter is concerned with a general description of the assumptions underlying the projections and the methodologies used to develop the projections. More detailed descriptions of these considerations are provided in subsequent chapters of the report that deal with specific health manpower fields.

OCCUPATIONAL COVERAGE

The information on health manpower presented in this report is for the most part limited to those health professions and occupations for which the Bureau of Health Resources Development (BHRD) has legislative responsibilities. The report is not designed to provide manpower supply estimates and projections for all personnel engaged in the health care delivery system. Manpower groups covered include *health professions*—physicians (M.D.'s and D.O.'s), dentists, optometrists, pharmacists, podiatrists, veterinarians, and registered nurses—and a selected number of *allied health professions and occupations.*

Estimates of the supply of occupational categories in public or community health manpower are not provided in this report. The field of public health is relatively unstructured, consisting of varying groups of professionals and other workers organized around specific problems. Thus separate estimates are not generally available of the number of persons in a specific discipline who work in community health. The reader, however, will find in Appendix C recent supply estimates for selected categories of public and community health personnel. As this document was being prepared, a report of the Task Force on Professional Health Manpower for Community Health Programs[1] was in process. The Task Force estimated the total number of professionals with master's level or higher training in 11 occupational categories of community health at about 9,700 in 1970.

The supply estimates presented in this document cover only "active workers"; i.e., those persons who are actively working in the health fields. In this respect, some of the data may differ from other published figures. It should be recognized too that these estimates have been obtained from a variety of sources and consequently the definition of "active" may vary by source. For an illustration of this situation, the reader is referred to the discussion in Chapter 3 of recent statistics available on "active" physicians.

In fact, many of the sources do not even define what is meant by "active," often leaving it up to individual survey respondents to designate whether they are active or not. In addition, the estimates include a number of persons who are working in a health occupation but may not be providing health services on a full-time basis. No attempt has been made to provide figures on the "potential" pool of workers, either current or projected, since inactive health manpower are not providing services related to the delivery of health care. It is important to note, however, that in some fields (such as nursing) there is a large pool of inactive trained workers who might be attracted back into active status under certain conditions.

The supply estimates of active workers cover both Federal and non-Federal personnel. The former category includes the Armed Forces, where data are available. For the health professions, current supply information is generally shown separately for the number active in each of these components. The projections of total supply, however, do not provide such separate estimates.

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[1] Task Force on Professional Health Manpower for Community Health Programs. (Thomas H. Hall, Coordinator.) *Professional Health Manpower for Community Health Programs, 1973.* Chapel Hill, N.C.: University of North Carolina, School of Public Health, Department of Health Administration, 1973.

Analysis of health manpower resources in individual occupations is often limited by the absence of common-time reference periods in the data. However, to provide a more consistent framework for analysis and in line with a general and growing interest among statistical agencies in comparability and uniformity of reporting, all current (and projected) manpower supply figures presented in this report utilize a December 31, 1970 base. Supply estimates provided here thus may differ in some instances from published data found in other sources. For example, 1970 estimates (December 31) shown here for active registered nurses are presented as 1971 estimates (January 1) in a number of other publications. Furthermore, published 1970 estimates for certain occupations, such as dentists, have often been reported as of July 1; new estimates for these occupations have been developed on a December 31 basis.

The fact that December 31, 1970 was utilized as the base year for the development of this volume does not mean that more recent manpower statistics are unavailable for some occupations. To the contrary, as in the case of M.D.'s, later manpower supply figures have been published. An effort has been made within individual chapters of this report to update selected trend tables where appropriate, and Appendix C presents additional updated figures.

PROBLEMS OF COMPARABILITY

The guidelines noted above provide the basic approach used to facilitate interoccupational comparisons. Other comparability problems also exist with respect to current and historical data. A number of these problems are described below.

SOURCES OF SUPPLY DATA

As indicated earlier, information on health manpower supply has been collected or estimated by a wide variety of groups, such as professional associations, other private organizations and institutions, and public agencies. This report utilizes the best available information on health manpower, from whatever source. The resulting data thus represent a rather heterogeneous assortment of survey findings, actual counts, and estimates based on professional judgment. In view of this heterogeneity, efforts are made in this report to indicate clearly the sources and derivation of the figures presented. Nonetheless, the presentation of current and projected manpower profiles based largely on secondary data sources in part reflects those limitations generally characteristic of such data.

GEOGRAPHIC COVERAGE

The geographic coverage of various series of health manpower data is by no means consistent. The lack of uniformity reflects, in part, limitations in the availability of data as well as program and historical considerations underlying the preparation of the estimates. In general, manpower supply information shown here for M.D.'s (including medical specialists), pharmacists, and veterinarians covers the 50 States, the District of Columbia, Puerto Rico, and the outlying territories. Data presented for other health professions cover only the 50 States and the District of Columbia.[2]

This lack of uniform geographic coverage poses some problems in developing common reference points for comparative purposes. But, given the magnitudes of the supply estimates, the slight variations in geographic coverage are believed to represent more of a conceptual than a practical limitation for analysis. Nevertheless, the existence of these variations should be noted in any interpretation of the statistics.

POPULATION COVERAGE

Manpower/population ratios are frequently found in the literature on health manpower and are an important tool in the analysis of resources and requirements. However, there is considerable variation in the population employed in the denominator of such ratios. In part, this lack of uniformity can legitimately be explained by conceptual considerations—the fact, for example, that the population served by one group of health personnel may indeed differ from population served by others. Other conceptual problems tend to create additional discrepancies—for example, in the population groups served by Federal health professionals both here and abroad. Apart from these considerations, there appears to be little agreement among the many data sources as to which population ratios are most relevant for a particular group of health workers. Population estimates used may vary in accordance with a particular reference period or with a particular area. The development of a uniform and conceptually valid population denominator to be used for all health occupations is desirable but virtually unattainable, given all these considerations. In this report, the population denominators used generally conform to those reported in *Health Resources Statistics*[3] and *Health*

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[2] Supply estimates for physicians and dentists include the Armed Forces both in the United States and abroad.

[3] National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Manpower Source Book, Section 20.[4] However, as discussed later in this chapter, a consistent population framework was developed for use with the supply projections.

MANPOWER CHARACTERISTICS COVERAGE

At the present time, current information is severely limited on the characteristics of the work force actively engaged in allied health professions and occupations; i.e. their age, sex, education, race, and mobility patterns. Although professional judgment has often been the key element in developing estimates of characteristics, the lack of reliable current data on this subject represents one of the more conspicuous deficiencies in the health manpower information system. Even in those health professions where data bases have been developed, the coverage is far from comprehensive and often not current.

This report provides information on selected major characteristics of health professions: age, sex, race, geographic distribution, professional activity, and type of practice or employer. Given the above data constraints, however, current information on even these characteristics is often not available for all occupations. The recent availability of data from the 1970 Census of Population has assisted in filling this void to some extent. For all tables presenting data on characteristics, the most recent information (generally in the form of percent distributions) was applied to the number of active health workers as of December 31, 1970 to provide "current" estimates. Where such procedures were adopted, they have been clearly noted in the text or on the tables. Other limitations that should be considered in interpreting these statistics have been detailed in subsequent chapters where they specifically apply.

HISTORICAL COVERAGE

The lack of uniformity in statistics on health manpower becomes much more apparent when historical data are considered. In addition to the points discussed above, two factors compound the comparability problems of historical data:

1. For any given occupation, no one source provides a complete and consistent series of historical estimates. In no field has a consistent and uniform set of statistics been developed and maintained over a period of time. In some instances, revisions in survey design or in other aspects of data collection have made earlier estimates not comparable.

2. For individual occupations, furthermore, different sources often provide conflicting estimates for given years.

Since relatively complete historical series are lacking, estimates for some years may be available from one source, while estimates for other years are available only from a different source. For an illustration of a dilemma incurred with "competing" historical data, see the discussion of historical data on optometrists in Chapter 6.

Despite these limitations, available trend data for individual health occupations are presented in this report. Given the variety of sources from which these estimates were obtained, however, comparability between (and sometimes even within) occupational groups may not be fully realized. Thus, any analysis of the trend data shown should be undertaken with caution and with cognizance of the sources and definitions noted. Small differences should not be overemphasized.

The inadequacy of some of the historical data also poses problems in developing projections of supply. Although historical supply has been examined and related to the projected estimates for comparative purposes, the historical estimates themselves have been used only sparingly in the projection methodologies employed in this report. As would be expected, the supply projections draw much more heavily on the fairly adequate data on enrollments, graduates, and educational institutions, so that the projections are believed to represent reasonable approximations of future resources.

PROJECTION ASSUMPTIONS AND METHODOLOGY

The supply projections presented in this report were largely developed by the Division of Manpower Intelligence. The projections provided for dental and nursing supply, however, were developed by the Divisions of Dental Health and Nursing, respectively. Given the limitations in the data available and the fact that different organizational units contributed to the report, the projection assumptions and methodologies tend to vary somewhat from one occupation to another. The general discussion which follows attempts to provide an overall framework for an understanding of the basic assumptions and methodologies used; detailed descriptions by occupation can be found in later chapters.

ASSUMPTIONS UNDERLYING THE PROJECTIONS

As stated in the Introduction the supply projections presented here were developed initially as the first phase of Project SOAR, a comprehensive analytical effort designed

[4] U.S. Department of Health, Education, and Welfare; Public Health Service; Bureau of Health Professions Education and Manpower Training. *Health Manpower Source Book 20. Manpower Supply and Educational Statistics for Selected Health Occupations: 1968.* Public Health Service Pub. No. 263, Section 20. U.S. Government Printing Office, 1969.

to provide useful inputs and insights for developing health manpower strategies and options at the national level. Consequently, it is essential that the reader be alerted at this point to the major considerations related to the assumptions that underlie the projections.

The supply projections developed for this report are, in essence, based on one critical set of assumptions relating to the future level and direction of financial support for schools and students, and the overall role of the public and private sectors in the health manpower production system. As a baseline concept, consequently, the projections assume that:

1. The number of first-year places mandated by Federal legislative provisions[5] existing at the end of 1972 would be maintained through academic year 1974-75; and

2. Upon the expiration of current legislation in fiscal year 1974, a combination of both public and private support would be available to at least maintain (but not necessarily increase) the productive capacity of schools needed to ensure the level of professional school enrollment resulting from these Acts. Hence, the assumption is that the health manpower production system will receive the future support from Federal or other sources that is needed for the maintenance and operation of the system at its assumed 1974-75 capacity level. Implicit in the assumption is that the effect on the health manpower production system of late-1972 levels of Federal biological research and medical support programs will not change significantly in the years ahead, and that the effects of military and Public Health Service recruitments and needs will remain roughly as they are today.

The rationale for such a set of assumptions largely reflects the original purpose for developing the supply projections; namely, as a useful input for planning and decision making. In effect, the projections were designed to provide "baseline" estimates of the future supply of health manpower, so that alternative health manpower education strategies could be examined for possible use in program and policy planning and evaluation. Given these considerations, it was believed that the most meaningful projections of supply would be those that would most reasonably reflect a setting removed from the sharp increases in enrollment of the late 1960's and early 1970's that were aided largely by Federal funding, but would still permit a long-run Federal role that seemed realistic. Thus, the projections assume that after fiscal year 1974, no further direct Federal support for construction or other inducements will be available to increase the enrollment of the Nation's health education and training institutions beyond those efforts already programmed in late 1972. However, they also imply a Federal presence if needed to maintain given levels of enrollment in health professional schools over the projection period.

Put in another way, the rationale underlying the set of assumptions was to provide estimates of what the likely future supply of health manpower would be if the manpower production system were to continue to operate in the general direction in which it appeared to be headed as of late 1972. The set of assumptions does not represent any official policy objective of DHEW.

On the basis of the assumption that some type of funding would be available to support and maintain capacity levels in institutions, a number of alternative projections were subsequently developed which attempted to capture different responses of the educational system to different assumed conditions. Specifically, high and low projections were undertaken for all the "health professions" but not for the "allied health occupations."

It must be recognized that a significant departure from the public and private health manpower role that existed in 1972 would tend to alter the realism of the assumptions. Because of the many factors to be considered, however, such as the interrelationships among the different Federal programs—in education and health as well as research—and the interface between Federal, State, and private interests, it becomes quite difficult to estimate quantitatively the possible impact upon the output of health occupation training programs and therefore upon the supply of health manpower. A major variable affecting the possible impact of any major funding changes in support, for example, would be the decisions made on the allocation of funds within the educational institutions themselves, which cannot be forecast at this time. Furthermore, any analysis would have to consider that major developments in programs not specifically identified with health manpower (e.g., changes in support for higher education programs) could also have an effect on the health manpower production system. Policies concerning all types of training programs will influence the production of health manpower to some immeasurable extent, especially in the area of biomedical research training.

Overall, from the beginning of the HPEA program in FY 1965 through FY 1973, a total of $826 million in Federal matching funds for construction has been awarded to 151 schools in the seven health professions. When construction is completed, these grants will result in 5,700 additional first-year student places and almost 5,900 more beds in teaching hospitals. The capitation grant program (and earlier formula grants) has resulted in total awards of $517

[5] The Comprehensive Health Manpower Training Act of 1971 replaced previous institutional (formula) grant authority with new authority for capitation grants, with incentives to encourage shortened curricula, promote assistants' training, and increase enrollment.

million since the first year of the program in FY 1966. Special project grants (including financial distress grants in FY 1972 and 1973) have amounted to $284 million since 1968. Student assistance in the form of loans (beginning in FY 1965) and scholarships (beginning in FY 1967) totalled $295 million through FY 1973. In addition, smaller amounts were awarded in FY 1972 and 1973 under the CHMT Act of 1971 for conversion of 2-year medical schools to degree-granting institutions, start-up assistance for new schools, teacher training, family medicine, etc.

Despite the difficulty of measuring its exact dimensions, the historical evidence on the output growth of health professions schools suggests that this Federal support has had a marked impact on the supply of health professionals. Evidence for a *prima facie* case on the impact of Federal support was recently presented in a Rand study on medical education.[6] As outlined in that study, for example, the strong Federal program thrust appeared to be responsible for a sizable number of medical schools (23) reversing their earlier record of only slight increases in enrollment to substantial increases in 1970-71.

Since the beginning of the program in FY 1965, 78 medical and three osteopathic schools have received construction assistance under the HPEA program through FY 1973. Nineteen of the 22 new medical schools built during this period were constructed with the help of Federal matching grants. Overall, when all construction funded through FY 1973 is completed, the Federal construction program will have resulted in the creation of over 3,200 new first-year places in medical and osteopathic schools. While it is virtually impossible to assign increases in first-year places to such parts of the HPEA program as formula grants and special project grants, the mandatory increases required for the FY 1972 capitation grants resulted in 935 additional first-year places in medical schools and 54 more in osteopathic schools.

As an illustration of the problems confronting estimation of the precise impact of Federal funding upon health manpower education, Federal programs specifically targeted on improving the supply of health manpower may have either a direct or indirect relationship, or both, to institutional output. Some programs, such as capitation support, are directly tied to enrollment increases, and the support is thus directly related to the institutions and their output capacity. Other programs such as special project grants, while targeted on specific manpower issues and educational goals, may not necessarily directly impact on output but may indirectly affect the institutional capacity through the support provided for faculty and other operating expenses. Given the need to consider individual decisions on allocations at the institutional level, it remains somewhat uncertain what the possible impact of shifting public and private funding policies might be in quantitative terms. For example, it is unknown at this point whether, or to what extent, support from State governments (even with revenue sharing) would be available to replace possible reduction in Federal funding support. And, given such a situation, it would be equally unknown at this juncture which schools would be affected or in what specific time frame.

The reader, therefore, must interpret the usefulness of the set of assumptions posed earlier and the resulting projections in the time frame of both their original development and the funding environment in late 1972. In this regard, the reader must also be reminded of the fact that projections have been developed here for a 20-year period, in which time the pattern of non-Federal support, as well as the Federal role, may change significantly, as it changed several times in the last decade.

The above discussion has focused entirely on critical assumptions and related issues pertaining to the *domestic* production of health personnel. With respect to the U.S. supply of physicians, however, unlike other health workers covered in this report, a significant segment of the working population in the Nation consists of graduates of *foreign* schools. Given the important role played by foreign medical graduates (FMG's) in the current health manpower pool, therefore, the reader should also be alerted at this point to the assumptions presented underlying the projections of the future flow of FMG's.

As indicated earlier, the rationale underlying the set of "domestic production" assumptions was to provide a future manpower profile likely to exist, given the general direction of the production system as of late 1972. To a large extent, the basic assumptions utilized to project the likely future size of the FMG population were developed along similar lines. In effect, these assumptions did not include the likelihood or the possibility of any major intervention in the FMG flow over the projection period, such as a significant modification in immigration and naturalization laws. To have included such a possible legislative change would have violated the purpose of this report—to provide baseline data that would be useful for planning—and would have produced estimates of limited value to planners. Consequently, a fine line was maintained between supply projections (as shown here) and forecasts.

The potential size of the annual inflow of FMG's into the health care system is believed by many to be almost limitless and perhaps even capable of equaling the output of U.S. medical schools. Barring any significant interventions,

[6] Carter, Grace M.; Chu, David S. C.; Koehler, John E.; Slighton, Robert L.; and Williams, Albert P., Jr. *Federal Manpower Legislation and the Academic Health Centers: An Interim Report.* Santa Monica, Cal., The Rand Corporation, December 1973 draft.

the factors currently operating to draw foreign-trained physicians into the United States are likely to continue in the future. For example, the economic incentive is likely to remain strong, since the average residency salary in this country is higher than the fully licensed physician's annual income in many countries of the world, particularly the countries that have provided the bulk of recent FMG's. In addition, the opportunities for graduate medical education and for satisfying and rewarding practice in the countries from which the largest proportion of FMG's are emigrating are not likely to be enhanced appreciably for many years to come.

In fact, however, although virtually all manpower experts anticipate continued growth in the size of the FMG population over time, no consensus has emerged regarding the future size of the annual additions. This lack of agreement reflects, in part, numerous questions about the reliability of both current and historical information on this segment of the physician supply. Different views have been articulated as to the impact of changes in immigration and licensing laws; for example, it is believed by some that the recent sharp increases in FMG entry reflect little more than a diminution of the backlog of FMG's in this country resulting from the recent changes in U.S. immigration laws.

In view of these considerations and given a number of limitations inherent in the data base (to be discussed later), several projections were developed, each of which viewed the recent (1970-71) FMG experience in a somewhat different light. The basic assumption utilized in this report viewed the 1970-71 increase in the FMG population (as measured by the American Medical Association) as the initiation of a continuing, but not accelerating, trend throughout the next two decades. Two other projections were also developed: (a) a "high" approach that assumed the recent experience to be the beginning of a new incremental trend in the supply of FMG's; and (b) a "low" approach that considered the 1970-71 increase as being atypically high for the coming years, with future trends in FMG supply assumed to revert to the growth pattern evidenced over the 1963-70 period.

In developing these projections, assumptions of virtually unlimited continuous growth in the supply of FMG's and, on the other hand, extremely sharp increases in the supply were both rejected as unrealistic. (Such a projection is shown in this report, but it is simply illustrative of the way in which large, possibly atypical, numbers can be extrapolated.) In this connection, one factor taken into consideration is the proposed abolition of the "free-standing" internship. Entry of foreign graduates into the United States presumably will be curtailed as greater numbers of U.S. graduates become available to fill training positions now vacant. In addition, with an elimination of the free-standing internship and a tightening of requirements for approval of residency training programs, which may develop as the Liaison Committee on Graduate Medical Education begins to function, one could anticipate a substantial reduction in the number of approved training programs and still further limitation in the slots available to FMG's.

Nonetheless, it is evident from the projections developed in this report that, regardless of the alternative adopted, the foreign-trained physician will continue to play an increasingly important role in the U.S. medical care system. To assess the desirability of this development, however, is beyond the scope of this report.

In sum, then, the projections of the supply of physicians presented here are as heavily dependent on assumptions relating to the future influx of FMG's as on assumptions about domestic production. For this reason, projections of the supply of physicians and medical specialists have been undertaken separately for U.S. and foreign graduates. It is hoped that such presentation will enhance understanding of the salient issues regarding each group as well as interrelationships between the two groups.

OVERVIEW OF PROJECTION METHODOLOGY

It is important for the reader to recognize at the outset that *the projections developed for this report relate to the future profiles of supply, independent of any considerations of demand.* The report must be viewed in the context of its development; namely, as the initial phase of a number of sequential analytic efforts. For planning purposes, it was considered analytically feasible and desirable to project supply and requirements independently, leaving synthesis and further modification in line with traditional economic supply-demand analysis to be undertaken later. (The project of which this report is a part is outlined in the Introduction.)

Although a number of arguments can be raised to support the position that the supply of many health groups is relatively inelastic in the short run (however defined), the fact remains that the presentation here pays only minor attention to some of the major *demand* dynamics of the health care system and their ultimate impact on supply. Such factors as productivity shifts, organizational changes (e.g., Health Maintenance Organizations), new developments in health insurance, licensure review, and task delegation, to name a few, may very well affect directly or indirectly the future education and supply of health manpower. The methodology as shown does not consider the impact of any one manpower projection on other related health personnel projections, such as the possible effect of a sharp increase in allied health manpower on the training and supply of other professional services or the impact of projected U.S.-trained M.D.'s on the future entry

patterns of FMG's. An examination of demand considerations such as these is beyond the purview of this report, in view of the fact that other efforts being undertaken within the Bureau of Health Resources Development (BHRD) will be concerned specifically with these points.

As indicated earlier, there is a considerable amount of empirical data on health professions, and therefore it has been possible to develop supply projections for all the major health professional groups. However, data on most allied health fields are limited to gross estimates of currently active personnel, with very little information on training of these workers or on the detailed characteristics of the supply, a fact which severely limits the options for utilizing adequate projection techniques. As a result, estimates of the future supply of allied health workers have been undertaken for only a selected group of professions and occupations—using as projected inputs only "appropriately trained" personnel, that is, those persons who will be receiving formal training in programs geared to the specific field in which they will be employed. Consequently, most of the following generalized discussion relates to the projection methodologies applied for health professions.

BASIC PROJECTION METHODOLOGY

In general, the basic methodological approach used to estimate total active supply was to estimate the flow of graduates into the active supply over the 20-year period and to estimate the losses to the existing work force during this period due to deaths and retirements. Except for minor variations, as in projecting the future supply of registered nurses, estimates have not generally been undertaken of the possible number of reentrants to the active supply during the projection period, since their numbers are believed to be relatively small in most health professions.

GRADUATE ADDITIONS. In developing the supply projections, the basic assumption has been made that no major new Federal programs aimed at increasing enrollments will exist at the expiration of current legislation and that Federal support will be at least sufficient to maintain enrollment levels resulting from earlier legislation. These baseline projections thus permit an evaluation of the future supply of manpower in the absence of the massive support of recent years to increase enrollment.

U.S. professional schools whose enrollments and graduates are projected in the general methodology include those schools identified in capitation grant applications filed with BHRD, as well as any schools where expectations were firm as to opening in the next few years. Projections of graduates through the latter 1970's were based largely on data and projections of first-year enrollment by schools on the applications.[7] Information submitted by schools on projected graduates was generally not used in this approach, since many schools excluded any consideration of attrition from their first-year enrollments in deriving their graduate estimates.

These "pipeline" estimates of enrollment provided the basis for projecting the number of graduates until approximately 1978. After that date, the number was more difficult to project. Given the assumption as to Federal support, a consensus seemed to prevail that enrollment would continue to increase for most health occupations but at a rate below that which characterized the late 1960's and early 1970's, when the impact of the Federal dollar was apparently greatest. This report consequently presents alternative projections of the graduate inflow, based upon different assumptions as to the possible future educational impact of this altered Federal involvement. The "basic" projection methodology used for each health occupation has utilized the specific graduate projection that seems most reasonable for that occupation. "High" and "low" estimates were also developed for a number of fields.

In addition to this consideration of enrollment changes over the 20-year period, it was also necessary to consider the matter of attrition. Estimates of student attrition vary: (1) between schools within the same field, (2) between occupations, and (3) over time. The basic projection methodology used in this report has generally been to adopt a recent attrition experience for schools within an occupation and maintain this rate for the length of the projection period. In some instances, information is presented on the impact upon the supply projections of using alternative estimates of student attrition.

The supply methodologies in this report also consider, where applicable, the existence of accelerated (abbreviated) programs in professional schools. Experts in the educational field have somewhat different views as to the likely course of such programs in the coming years. For example, there are some indications that such programs present problems and the current shift in this direction may slow down. A more detailed discussion of this topic, as it relates particularly to medical schools and projected graduates, can be found in Chapter 3.

This discussion of graduate additions has thus far been concerned solely with the projected supply of U.S. graduates. However, a significant input to the current and

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[7] It should be noted that schools often revise (update) their first-year enrollment figures after initial submission of capitation grant applications to BHRD. Because schools indicate these changes at varying points during the year, BHRD makes an effort to tally the responses periodically. Projections of supply developed in this report were based on fiscal year 1972 applications tallied as of Fall 1972.

projected supply of physicians is represented by foreign-trained physicians. Although foreign graduates also provide an input into some other health occupations, their numbers are small, and the projection methodologies employed for these groups did not include projected estimates of their foreign-trained components.

Because of the critical importance of physicians and the FMG component, however, alternative assumptions of FMG's have been developed to provide several different projections of active physicians. The treatment of this group of physicians is covered in considerable detail in Chapters 3 and 4.

SEPARATIONS FROM THE LABOR FORCE. In addition to the flow of graduates into the manpower pool over time, estimates of the future supply of active workers are also dependent on such factors as losses to the active work force through death, retirement, and occupation shifts, as well as reentry of workers into the active pool. The approach undertaken in this report has generally been to provide estimates only of the losses to active supply incurred through deaths and retirements.

In general, information on separation and reentry patterns relating specifically to health occupations is rather limited. Although a number of cohort analyses have been undertaken, the scope of the studies has often been too limited to permit a direct transfer of the results to the active work force at large. In some instances, projections of supply reported in the literature have made no allowance for losses to the occupation. In others, arbitrary estimates of losses have been developed, with no consideration given to the age characteristics of the occupation analyzed.

For most occupations for which projections are presented in this report, estimates of deaths and retirements have been computed utilizing age-specific separation rates for the general working population as an initial input.[8] The use of age-specific data has been adapted to reflect differences in estimated losses among professions accounted for by variations in respective age distributions. Wherever possible, attempts have been undertaken to provide reasonable approximations of death and retirement patterns for each occupation, depending on the extent of supportive empirical evidence available.

Age-specific death rates for the general work force (usually male workers) have been utilized to estimate the mortality losses for most occupational groups. One notable exception to this approach is the mortality estimates for physicians, where an adjusted death rate series was developed utilizing the mortality patterns of male workers modified on the basis of empirical data on the longevity experience of physicians.

[8] Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review*, 94: 49-55, June 1971.

For a number of the health occupations covered in this report, there exists evidence that these professionals tend to have a somewhat longer working life than does the general working population. Where such evidence was available, a number of occupation-specific series of retirement rates were constructed, based initially on the generalized retirement patterns for male workers. This approach was applied to physicians, optometrists, podiatrists, and veterinarians. A variation of this approach was adopted for dentists.

A brief description of the particular separation methodology utilized for each occupation is presented in respective occupational chapters in Part II. A more detailed examination of the assumptions, underlying rationale, and methodology is presented in Appendix A. Some of the limitations of the general approach, however, should be noted at this time:

1. Separation rates were applied both to the supply of active health manpower in 1970 and to the estimated graduate input to 1990. With respect to the latter, possible composition changes among graduates in coming years could very well alter separation estimates for a number of occupations. For example, growing proportions of both females and Blacks may result in somewhat different death and retirement patterns than those applied here. This may be particularly true for the pharmacy profession where a significant increase in female pharmacists is expected over the coming years.

2. The separation patterns in existence today are likely to be different from those that will prevail over the next 20 years, both as to patterns experienced by the general working population and by workers in individual occupations. Increasing trends to greater leisure time, for example, may have a significant impact on retirement patterns.

3. As indicated above, the projection methodology generally did not make allowances for the possible reentry of workers into the active manpower pool. In view of the fact that most health professions except nursing have relatively small proportions of females—a segment of the work force that generally exhibits high turnover—the assumption was made that reentry into these professions (except for pharmacists) would tend to have only a slight effect upon the overall supply projections. Here too, however, compositional shifts which may occur in certain occupations over the next two decades might alter the validity of this assumption.

DEVELOPMENT OF SPECIALTY PROJECTIONS FOR MEDICINE

In general, most projections of health manpower supply in the literature have largely been confined to providing an aggregate measure of supply. Despite continued concern

about "shortage" problems, little attention has been directed to projecting such distributional aspects of supply as the degree of specialization among health workers. This consideration is critically needed in order to evaluate the relationship between the composition of supply and requirements in the years ahead. Supply projections of specialties, furthermore, are not only useful in analyzing the dimensions of problems of maldistribution but also serve to shed further insight into the projected estimates of overall supply.

In addition to providing basic and alternative projections of total active supply to 1990, this report presents projections for a selected number of medical specialties. These projections have been controlled to the independent projections of total active supply discussed earlier (specifically M.D.'s). The general approach undertaken was first to project the distribution of the supply of health professionals who were active in 1970 and were estimated to survive to 1975, 1980, 1985, and 1990. In this approach, no intercategory shifts were assumed for the projection period. Specialty distributions were then estimated for the graduate entrants over the 20-year period. Any evaluation of the numerical findings of these projections must be undertaken cautiously, with full awareness of the assumptions and caveats outlined above and in Chapters 3 and 4.

POPULATION ESTIMATES AND RATIOS

Where applicable, the projections of supply have been related to population projections in order to provide an easy and simple means of assessing the implications of the projections. As indicated earlier, an effort was made to provide a consistent framework for the population ratios used with the supply projections. The supply projections of total numbers active in each of the health professions (as well as historical estimates within the same tables and discussion[9]), are related to projections of the total resident population developed by the Bureau of the Census.[10] It is important to note that the primary rationale for the use of a single set of population projections was to provide the most reasonable and comparable framework for trend evaluations. Although ratios for any given year are affected to some degree by the population base adopted (either total or civilian resident population), the trends over the projection period are little affected.

The choice of the specific population series was largely determined by the desirability of obtaining consistent population projections for both the Nation overall and for States. Although the Bureau of the Census has published a number of population projections for the entire United States, only two are available by State. Of these, the Series I–E projection was selected on the basis that its assumptions about fertility rates more closely approximate the current pattern. As indicated in Table 1, population estimates obtained from Series I–E are somewhat lower than other population projections published by the Bureau of the Census. The use of this series in this report thus results in higher population ratios than would be derived by applying any of the other series. Table 2 provides the projected population figures for individual geographic areas[11].

Table 1.

ALTERNATIVE PROJECTIONS OF U.S. POPULATION: JULY 1, 1975-90

[In 1,000's]

Year	Resident population Series I-E	Total population, including Armed Forces overseas			
		Series B	Series C	Series D	Series E
1975.....	214,883	218,177	217,375	216,561	215,703
1980.....	226,934	236,725	233,798	230,855	227,765
1985.....	239,329	257,903	252,093	246,265	240,153
1990.....	250,630	278,570	269,673	260,762	251,431

Source: Resident population: U.S. Bureau of the Census. *Current Population Reports.* Series F-25, No. 477.
Total population, including Armed Forces abroad: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 470.

Note: Resident population series shown above (column 1) is used for the projected population ratios presented in this report.

[9] In chapters for individual health professions, tables and discussions of current characteristics and historical trends utilize population ratios that employ denominators generally covering the same geographic areas as the manpower data in the numerators. In those sections where projected population ratios are compared to ratios for 1960 and 1970, the population denominators of the 1960 and 1970 ratios conform to the series used for the projections in order to provide comparability in the estimates.

[10] U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 477.

[11] These population estimates are currently being used in exploratory projection activities undertaken by BHRD concerned with the geographic distribution of health manpower supply.

Table 2.

PROJECTIONS OF THE RESIDENT POPULATION OF GEOGRAPHIC REGIONS, DIVISIONS, AND STATES: JULY 1, 1975-90

Region, division, and state	1975	1980	1985	1990
UNITED STATES	214,883	226,934	239,329	250,630
NORTHEAST	51,187	53,499	55,927	58,152
NEW ENGLAND	12,534	13,252	13,997	14,682
Connecticut	3,283	3,551	3,825	4,082
Maine	1,003	1,016	1,031	1,044
Massachusetts	5,977	6,277	6,588	6,869
New Hampshire	807	878	950	1,019
Rhode Island	985	1,027	1,068	1,104
Vermont	474	504	535	563
MIDDLE ATLANTIC	38,653	40,246	41,930	43,471
New Jersey	7,725	8,300	8,906	9,487
New York	18,964	19,789	20,660	21,401
Pennsylvania	11,964	12,157	12,364	12,529
SOUTH	66,327	69,927	73,539	76,784
SOUTH ATLANTIC	32,757	34,860	36,942	38,817
Delaware	601	655	709	758
District of Columbia	(1)	(1)	(1)	(1)
Florida	7,557	8,280	8,980	9,626
Georgia	4,887	5,191	5,494	5,761
Maryland	4,348	4,782	5,225	5,637
North Carolina	5,277	5,482	5,682	5,852
South Carolina	2,658	2,731	2,800	2,855
Virginia	4,936	5,229	5,512	5,755
West Virginia	1,681	1,634	1,598	1,565
EAST SOUTH CENTRAL	13,106	13,440	13,793	14,100
Alabama	3,500	3,565	3,634	3,692
Kentucky	3,290	3,372	3,461	3,540
Mississippi	2,227	2,245	2,268	2,288
Tennessee	4,089	4,259	4,430	4,581
WEST SOUTH CENTRAL	20,464	21,627	22,804	23,867
Arkansas	1,986	2,052	2,126	2,195
Louisiana	3,807	3,975	4,141	4,285
Oklahoma	2,669	2,787	2,912	3,029
Texas	12,002	12,812	13,625	14,358
NORTH CENTRAL	59,242	62,059	65,037	67,741
EAST NORTH CENTRAL	42,415	44,674	47,042	49,186
Illinois	11,666	12,256	12,885	13,464
Indiana	5,483	5,782	6,093	6,370
Michigan	9,445	10,031	10,639	11,193
Ohio	11,152	11,675	12,218	12,693
Wisconsin	4,669	4,930	5,207	5,466

See footnote at end of table.

Table 2.

PROJECTIONS OF THE RESIDENT POPULATION OF GEOGRAPHIC REGIONS, DIVISIONS, AND STATES: JULY 1, 1975-90—Continued

Region, division, and state	1975	1980	1985	1990
NORTH CENTRAL—Continued				
WEST NORTH CENTRAL	6,828	17,385	17,995	18,555
Iowa	2,861	2,908	2,962	3,009
Kansas	2,287	2,334	2,386	2,432
Minnesota	4,021	4,245	4,483	4,703
Missouri	4,866	5,070	5,288	5,491
Nebraska	1,525	1,570	1,620	1,664
North Dakota	607	600	597	594
South Dakota	660	658	660	662
WEST	38,126	41,449	44,825	47,952
MOUNTAIN	8,956	9,617	10,286	10,894
Arizona	1,974	2,164	2,352	2,523
Colorado	2,423	2,636	2,848	3,042
Idaho	735	761	790	817
Montana	703	721	739	757
Nevada	584	673	759	836
New Mexico	1,052	1,088	1,126	1,160
Utah	1,146	1,234	1,322	1,400
Wyoming	336	342	351	360
PACIFIC	29,171	31,832	34,539	37,059
Alaska	328	352	374	392
California	22,077	24,226	26,429	28,496
Hawaii	828	874	908	933
Oregon	2,257	2,421	2,591	2,749
Washington	3,682	3,958	4,236	4,489

[1] Projection methodology does not yield reasonable estimates for the District of Columbia but the estimates for this area have been included in totals for division, region, and the United States.

Source: U.S. Bureau of the Census. *Current Population Reports*, Series P-25, No. 477.

Note: Figures may not add to totals and subtotals due to independent rounding.

Chapter 2 • PROJECTIONS OF HEALTH MANPOWER SUPPLY—A SUMMARY

The Nation's health manpower profile has changed significantly over the past decade. In 1970, the overall supply of active health professionals and allied workers totaled about 4 million. (See Tables 3 and 4.) This number was about 56 percent (or 1.4 million) higher than the level of 10 years earlier. Slightly more than three-fourths of this growth was concentrated among allied health personnel, reflecting their increased utilization, as well as greatly increased employment opportunities that resulted from changes in the health care delivery system. Between 1960 and 1970, the allied health work force rose from 1.5 million to approximately 2.7 million (an increase of about 80 percent), as compared with the 30 percent rise in the number of health professionals, whose numbers increased from 1.0 to 1.3 million.

It should be remembered that the supply projections presented in this report generally suggest a continuation of these rapid growth patterns over the next two decades. As indicated earlier, however, projections of the supply of allied health workers, owing to the severe data weaknesses which currently exist, have been undertaken only for selected allied groups, with the coverage of the 1970 active base confined to credentialed personnel and new entrants limited to graduates of "approved" educational programs. As a result, a comprehensive profile of the total health manpower pool has not been provided here. Nevertheless, the detailed estimates of the future supply of all health professionals, when coupled with the selected allied health estimates, provide valuable insights into the Nation's future health manpower situation.

SUPPLY OF HEALTH PROFESSIONS

For health professions, the overall supply of active workers is projected to increase from 1.3 million in 1970 to 1.9 million in 1980 and to 2.5 million in 1990. (See Table 5.) This represents a gain of 87 percent over the 20-year period, or an average annual rate of growth of 3.3 percent

Table 3.

SUPPLY OF ACTIVE HEALTH PROFESSIONALS: DECEMBER 31, 1970

Health profession	Number active	Health profession	Number active
All health professions	1,329,130		
Physicians	323,210		
D.O.'s	12,000		
M.D.'s	311,210		
General practice	56,260		
Medical specialties	66,380		
Dermatology	4,000		
Family practice	1,690		
Internal medicine	41,870		
Pediatrics[1]	18,820		
Surgical specialties	85,390		
General surgery	29,760		
Neurological surgery	2,580		
Obstetrics and gynecology	18,880		
Ophthalmology	9,930		
Orthopedic surgery	9,620		
Otolaryngology	5,410		
Plastic surgery	1,600		
Thoracic surgery	1,810		
Urology	5,800		
		Other specialties	103,190
		Anesthesiology	10,860
		Child psychiatry	2,100
		Neurology	3,070
		Psychiatry	21,150
		Pathology	10,280
		Physical medicine and rehabilitation	1,480
		Radiology	10,520
		Therapeutic radiology	870
		Miscellaneous	42,860
		Dentists	102,220
		Optometrists	18,400
		Pharmacists	129,300
		Podiatrists	7,100
		Veterinarians	25,900
		Registered nurses	723,000

[1] Also includes pediatric allergy and pediatric cardiology.

Source: For sources of data in this table, see tables in chapters on each occupation.

Note: Figures may not add to total and subtotals due to independent rounding.

Table 4.

SUPPLY OF TOTAL ALLIED HEALTH MANPOWER, BY OCCUPATION: DECEMBER 31, 1970

Allied health occupation	Number active
Total allied	2,743,000
Medical allied	1,073,000
Medical laboratory personnel	140,000
Radiologic technology personnel	100,000
Medical record personnel	53,000
Dietetic and nutritional personnel	47,000
Physical therapy personnel	24,000
Occupational therapy personnel	16,000
Other personnel	693,000
Dental allied	158,000
Dental hygienists	15,000
Dental assistants	112,000
Dental technicians	31,000
Environmental allied	242,000
Environmental engineers	35,000
Environmental scientists	25,000
Environmental sanitarians	12,000
Environmental technicians	69,000
Environmental aides	101,000
Nursing allied	1,270,000
Licensed practical nurses	400,000
Nursing aides, orderlies, attendants	848,000
Home health aides	22,000

Source: Dental allied: BHRD, Division of Dental Health
All other occupations: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

(compounded), somewhat above that registered between 1960 and 1970. The gain in the 1970's is projected to be somewhat faster than in the 1980's, for health professions as a group, as well as for individual fields.

It should be reiterated at this point that these aggregate estimates (as well as the figures for individual occupations discussed later), have been developed under a basic assumption about the future direction of Federal legislation and overall financing of education in health fields. In general, this assumption states that upon expiration of current legislation, the amount of overall public and private funding provided would be such as to maintain at least the current level of professional school enrollment. More detailed discussions of specific assumptions, methodologies, and findings are presented in subsequent chapters of the report.

Although the overall supply of active health professions is projected to increase by nearly 90 percent between 1970 and 1990, growth patterns are expected to vary considerably among the individual professions. (See Table 5.) Over the 20-year period, for example, increases in supply are projected to range from a high of about 100 percent for registered nurses to a low of approximately 40 percent for pharmacists. In general, the compositional changes in the overall health professions pool that were in evidence during the 1960's are expected to continue.

The professions which registered the sharpest increase in supply during the 1960's—registered nurses, veterinarians, and physicians—are projected generally to post the sharpest gains during the 1970-90 interval. In 1990, these three occupations combined are projected to account for 85 percent of all active health professions, compared with 78 percent in 1960 and 81 percent in 1970.

PHYSICIANS

The Nation's supply of active physicians has grown substantially over the past two decades and is projected to rise at a somewhat sharper pace over the next two. The supply of active M.D.'s and D.O.'s rose from 220,000 in 1950 to 251,900 in 1960 and to 323,200 in 1970, an increase of about one-half over the 20-year period. (See Table 5.) This expansion has been particularly marked in recent years, reflecting both the greater output from U.S. medical and osteopathic schools and increased entry into the United States of M.D.'s trained abroad.

The increase in the output of U.S. medical and osteopathic schools in large part reflected the impact of Federal legislation, beginning with the Health Professions Educational Assistance Act of 1963. Since academic year 1963-64, for example, the number of medical schools rose from 87 to 103 (in 1970-71), and first-year enrollment grew from 8,800 to 11,348. In addition to developments such as these, immigration of M.D.'s trained abroad has doubled the Nation's pool of foreign-trained physicians since the early 1960's. In 1971, active foreign-trained M.D.'s (excluding graduates from Canadian medical schools) numbered 59,600, or 18.5 percent of all active M.D.'s, as compared with 30,300, or 11.6 percent of the total active in 1963.

Under the basic methodology utilized in this report, the supply of active physicians (M.D. and D.O.) is projected to grow from 323,200 in 1970 to 593,800 in 1990. This increase represents an average annual growth rate (compounded) of 3.1 percent, somewhat above the rate of 2.5 percent posted between 1960 and 1970. The gain is projected to be slightly more rapid in the 1970 decade than in the 1980's. As a result of these substantial increases, the ratio of active physicians to total resident population is projected to rise substantially. In 1970, there were 159

physicians for each 100,000 population; the ratio is expected to reach 197 by 1980 and 237 in 1990.

In evaluating these figures, it is important to recognize several key assumptions that underlie them:

Assumption 1. Upon expiration in FY 1974 of the Comprehensive Health Manpower Training Act of 1971, aggregate public and private funding will be adequate to at least maintain (though not necessarily to increase) the productive capacity of professional schools needed to ensure the continuation of enrollments at the level resulting from this Act. This assumption accounts in part for the projection of a slightly lower rise in physician supply for the 1980's. Since the current legislation concerns itself with enrollment increases through academic year 1974-75, the impact of the legislation (unless altered) upon the Nation's supply of M.D.'s and D.O.'s will be felt through the latter 1970's. Enrollment increases upon expiration of the current legislation are still assumed to occur, but at a reduced pace. The assumed enrollment growth for the remainder of the projection period, consequently, results in a slightly slower expansion of the M.D. and D.O. pool in the 1980-90 period.

Under the basic methodology, consequently, first-year enrollment in U.S. medical schools is projected to grow from 11,348 in academic year 1970-71 to 14,339 in 1974-75; 15,321 in 1979-80; and 16,811 in 1986-87. With assumptions about attrition among students (See Chapter 3), the projections of first-year enrollment result in a total graduate input of approximately 270,000 M.D.'s over the next two decades. The number of M.D.'s graduating is projected to rise from 8,979 in 1970-71 to 15,920 in 1989-90, an increase of 77 percent. This compares with an increase of 28 percent between academic years 1960-61 and 1970-71. Similar increases for osteopathic graduates are also projected for the next 20 years.

Assumption 2. U.S. medical and osteopathic schools will be financially able to maintain the projected output of graduates. Projections for first-year enrollments and subsequently for graduates become meaningful only to the extent that existing and assumed new schools remain financially able to accommodate these numbers. Compared to that for most health professions, however, private and non-Federal public funding for medical and osteopathic schools promises to represent a presence that will be most

Table 5.

SUPPLY OF ALL ACTIVE HEALTH PROFESSIONALS, USING BASIC METHODOLOGY: ACTUAL 1960 AND 1970; PROJECTED 1980 AND 1990

Year	All health professions	Physicians (M.D. and D.O.)	Dentists	Registered nurses	Optometrists	Pharmacists	Podiatrists	Veterinarians
	Number active							
1960	1,029,620	251,900	90,120	527,000	16,100	117,800	7,000	19,700
1970	1,329,120	323,200	102,220	723,000	18,400	129,300	7,100	25,900
1980	1,885,370	446,800	126,170	1,099,600	21,800	146,100	8,500	36,400
1990	2,484,410	593,800	154,910	1,466,700	28,000	179,900	13,000	48,100
	Percent distribution							
1960	100.0	24.5	8.8	51.2	1.6	11.4	0.7	1.9
1970	100.0	24.3	7.7	54.4	1.4	9.7	0.5	1.9
1980	100.0	23.7	6.7	58.3	1.2	7.9	0.4	1.9
1990	100.0	23.9	6.2	59.0	1.1	7.2	0.5	1.9
	Rate per 100,000 population[1]							
1960	572.1	140.0	50.1	292.8	8.9	65.5	3.9	10.9
1970	652.1	158.6	50.2	354.7	9.0	63.4	3.5	12.7
1980	830.8	196.9	55.6	484.5	9.6	64.4	3.8	16.0
1990	991.3	236.9	61.8	585.2	11.2	71.8	5.2	19.2

[1] Resident population as of July 1.

Source: For sources of manpower data in this table, see tables in chapters on each profession.

Note: Figures may not add to totals due to independent rounding.

supportive to educating and producing future streams of physicians into the existing pool.

In recent years there has been a substantial increase in the number of young people expressing interest, and actively seeking careers, in health occupations. The pressure thus exerted on enrollment in health professions and allied educational programs, specifically in the area of physicians, is likely to be forceful. For example, applications for admission to medical school now approximate three times the number of first-year places available. In addition, the whole set of dynamics surrounding the increased role of the female and racial-ethnic minorities in the functioning of our society provides a strong forcing function to encourage continued and perhaps sharply increased non-Federal financial support to medical education.

Assumption 3. Foreign trained M.D.'s will continue to increase the U.S. supply annually in approximately the same numbers as they did in 1970-71. If so, the projected growth in their number would account for slightly less than two-fifths of the total growth in physician supply over the 1970-90 period, similar to the substantial input accounted for by foreign medical graduates (FMG's) during the 1960's. This means that foreign trained physicians (including the Canadian trained),[1] would represent almost one-third of all active physicians in 1990, compared to about one-fifth in 1970.

More specifically, the supply of active U.S. trained physicians alone is projected to increase by 166,600, or by over 60 percent, over the projection period—from 263,200 in 1970 to 429,800 in 1990. In contrast, the supply of all active FMG's in the United States is projected to nearly triple by 1990, growing from about 60,000 in 1970 to 164,000 in 1990. This rapid growth among the FMG population represents an average yearly gain of about 8 percent (compounded), corresponding quite closely to the 9 percent yearly increase registered during the 1963-70 period.

Assumption 4. The supply flow will be generally unaffected by any significant changes in the health care delivery system.

[1]Ideally, it would be most desirable if this document could present throughout separate data on U.S. trained physicians and medical graduates from foreign schools, including Canadian schools. This would be consistent with the legislative mandate of the Bureau of Health Resources Development (BHRD) for funding professional education only in U.S. schools. Unfortunately, such separation cannot be fully achieved because certain published data on physicians, such as internship and residency statistics, often combine statistics on U.S. trained M.D.'s with counterpart data on graduates of Canadian schools. In these instances, it is not possible to separate out the relevant information for U.S. trained M.D.'s alone.

MEDICAL SPECIALISTS

Although the overall supply of physicians is projected to increase rapidly to 1990, this expansion may not significantly alter the current specialty distribution. In 1970, for example, the supply of active M.D.'s was distributed unevenly among specialties, and this pattern had not been significantly changed by the growth in supply over the past decade.

The largest numbers of M.D.'s (both U.S. and foreign-trained) are in general practice and in the five traditional specialties: internal medicine, general surgery, psychiatry, obstetrics and gynecology, and pediatrics. There have been only small changes in the composition of specialty manpower since the early 1960's, with the exception of physicians in general practice, whose numbers declined by about 15 percent between 1963 and 1970. However, the decline in the number of general practitioners does not necessarily represent a decline in the number of M.D.'s providing primary care. In many instances, the functions of general practice have partially shifted to specialists in internal medicine and pediatrics. In addition, the most recent specialty to be recognized is that of family practice, which had its specialty board established in 1970, and there are indications of rapid growth for this specialty in the coming years. At the present time, one-half of the Nation's medical schools have programs of family practice either started or in the planning stages, and indications are that many medical students are interested in this specialty.

The basic projections developed in this report suggest variations in growth patterns among individual specialties, with the medical and surgical specialties growing the most rapidly. (See Table 6.) Among the 22 specialties analyzed, neurology is projected to demonstrate the largest annual average growth rate in the next 20 years—6.8 percent (compounded) between 1970 and 1980 and 4.7 percent (compounded) between 1980 and 1990. Otolaryngology, in contrast, is projected to exhibit the slowest growth rate (about 2.8 percent compounded) over the projection period. For general practitioners, the numerical declines of recent years are projected to continue through 1990, with the supply falling from 56,260 in 1970 to 36,700 in 1990. However, substantial growth in the primary care specialties of family practice, internal medicine, and pediatrics and minimal growth in obstetrics and gynecology should serve to largely offset the decline in general practice. As outlined later, developments in medical specialties relate closely to the impact of foreign-trained physicians and the assumptions about FMG's used for the projection.

A number of alternative projections were also developed to show the projected distribution of physicians among

Table 6.

SUPPLY OF ACTIVE PHYSICIANS (M.D.), BY MAJOR SPECIALTY GROUP: ACTUAL 1963 AND 1970; PROJECTED 1975-90

Specialty group[1]	1963[2]	1970	1975	1980	1985	1990
	Number of active physicians					
Total	261,730	311,210	363,870	430,240	499,440	571,030
General practice	66,870	56,260	51,910	47,210	42,110	36,700
Medical specialties	46,520	66,380	86,210	110,750	136,490	163,240
Surgical specialties	67,010	85,380	106,750	133,550	161,660	190,870
Other specialties	81,330	103,190	119,000	138,720	159,180	180,210
	Percent distribution					
Total	100.0	100.0	100.0	100.0	100.0	100.0
General practice	25.5	18.1	14.3	11.0	8.4	6.4
Medical specialties	17.8	21.3	23.7	25.7	27.3	28.6
Surgical specialties	25.6	27.4	29.3	31.0	32.4	33.4
Other specialties	31.1	33.2	32.7	32.2	31.9	31.6

[1] A more detailed listing of the specialties included within each group can be found in table 30.
[2] See table 30 for explanation of adjustment of these figures.
[3] Excludes 1,690 diplomates in family practice who have been included in figure for medical specialties.

Source: 1963: Theodore, C. N. and Sutter, G. E. *Distribution of Physicians in the U.S., 1963.* Chicago, American Medical Association, 1967.

1970: Haug, J. N.; Roback, G. A.; and Martin, B. C. *Distribution of Physicians in the United States, 1970.* Chicago, American Medical Association, 1971.

Note: Figures may not add to totals due to independent rounding.

individual specialties. On balance, however, the resulting distributions did not appear to differ substantially from the pattern shown using the basic methodology. Despite this consideration, it should be noted that all of the projections undertaken here for the specialties are limited by lack of available data on physicians who spend their time and work efforts among a number of different specialties. In other words, in accordance with available published data, a physician has been designated to only one specialty on the basis of that area in which he reports most hours of work. The absence of information on functional distributions of time, and the corresponding implications for the supply projections, are described in greater detail in Chapter 4.

REGISTERED NURSES

Registered nurses form by far the largest group of health professionals. In 1970, the active supply of R.N.'s numbered 723,000, or more than half of the total health professional work force, a substantial increase (37 percent) over the 527,000 active R.N.'s in 1960.[2] (See Table 5.) The projections provided here indicate further substantial growth in the supply of R.N.'s over the next 20 years, at an average annual growth rate (3.6 percent compounded) somewhat above the experience of the 1960's (3.2 percent). A slowing down in the rate of growth is expected to occur during the latter 10 years of the period. In the 1970-80 decade, the supply of nurses is expected to increase by more than one-half, or at a greater rate than during the 1960-70 decade. The slower pace projected for the 1980-90 decade reflects assumptions about the future course of admissions to nursing programs, which are discussed in detail in Chapter 10.

During the middle and latter 1960's, the effects of the Nurse Training Acts of 1964 and 1971 and the Health Manpower Act of 1968 on nursing education were significant. Prior to enactment of the Nurse Training Act in

[2] Since the preparation of this chapter, revised estimates of the 1970 supply of active R.N.'s have been developed. See p. 130 for a brief explanation of this change.

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1964, for example, total enrollment in programs preparing registered nurses was approximately 129,000. By 1970, total enrollment had grown to nearly 165,000, an increase of 27 percent. This compares with 9 percent growth between 1960-61 and 1964-65. The number of programs, furthermore, rose from 1,137 in 1960-61, to 1,158 in 1964-65, and to 1,355 by 1970-71.

Continued increases in admissions and, subsequently, in the supply of registered nurses seem inevitable given the current indication of the attraction of the occupation to young people. In this regard, the increased recognition of the numerous ways in which R.N.'s can and do contribute to the provision of health care has, in part, resulted in this development. In addition, the attractiveness of this field may continue to be enhanced as the increased employment of other health workers serves to allow R.N.'s to utilize their professional skills.

DENTISTS

Between 1960 and 1970, the supply of active dentists rose from 90,120 to 102,220. (See Table 5.) Since this increase represented an average growth rate below that evidenced for all health professions as a group, the proportion that dentists comprise of the total health professions fell from 8.8 to 7.7 percent. The projections provided here for this group indicate further declines in the proportion to 6.2 percent in 1990. Nevertheless, the supply of active dentists is projected to rise from 102,220 in 1970 to 154,910 in 1990—an average annual growth rate of 2.1 percent (compounded). Although this growth rate is somewhat slower than that for all health professions combined (2.6 percent compounded), it is nearly twice as fast as the growth in supply during the 1960-70 period (1.3 percent). Overall, the ratio of dentists to population is projected to increase from 50 per 100,000 in 1970 to 62 per 100,000 in 1990.

An examination of dental school enrollment over the past two decades reveals striking evidence of the substantial impact upon enrollment of the formula and special project grant provisions of the Federal legislation in recent years. During the past decade, for example, the average rate of increase in total dental school enrollment was about 2.3 percent, compared to annual gains of 1.2 percent experienced through the 1950's. Since 1965, however, coincident with the initiation of Federal legislation, this average annual gain has approximated 3.6 percent. These developments in enrollment have, in turn, resulted in similar trends among graduates of dental schools over the historical period.

Although enrollment is projected to increase substantially in the next few years, the picture over following years will in all likelihood witness a dramatic slowdown in the rate of growth (under the legislative assumption posed earlier). Historical evidence suggests strongly that the growth of dental school enrollment may very well be somewhat slow in the absence of Federal funding for enrollment increases assumed for the period after academic year 1974-75. The reader should keep in mind, however, that the basic assumption is that aggregate funding after 1974-75 be such as to at least maintain the level of dental school enrollment resulting from the current Federal legislation and efforts by non-Federal public agencies and private sources.

PHARMACISTS

As with active dentists, pharmacy manpower is projected to increase more rapidly in the 1970-90 period than during the 1960's—at a 1.7 percent annual rate as compared with a 1.0 percent rate. However, pharmacists as a proportion of the overall health professional work force are expected to continue to decline somewhat, as they did in the 1960-70 period. Between 1960 and 1970, the proportion that active pharmacists represented of the overall professional work force fell from 11.4 percent to 9.7 percent. Although the active supply is projected to increase from 129,300 to 179,900 over the 20-year period, the proportion they represent of the overall professional supply is projected to decline to about 8 percent in 1980 and 7 percent in 1990. (See Table 5.)

As with other health professions enrollment trends of pharmacists have reflected the impact of Federal legislation upon the course of health professions education. In the last decade, for example, third-to-last year enrollment[3] rose from 4,145 in academic year 1962-63, to 4,491 in 1964-65, and to 5,864 by 1970-71. Between academic years 1970-71 and 1971-72, furthermore, the number of these enrollees rose by over 600 students, or by 11 percent. Under the basic methodology (and assumptions) used in this report, the number of third-to-last year students is projected to rise sharply by 1974-75 (to about 7,300) and then to continue increasing over the projection period, reaching 8,854 by 1987-88.

Continued enrollment and supply increases in pharmacy are virtually assured by several factors that, although not unique to the occupation, pose prominent attractions to

[3]Enrollments are reported for only the last 3 years of pharmacy school programs leading to the B.S. and B.Pharm. degrees, but figures include students who are studying for the Pharm.D. as their first degree. These are the most meaningful figures which can be obtained on a national basis because many pharmacy colleges admit students after 2 collegiate years and enroll them for 3 professional years.

the field. The profession provides considerable opportunities for part-time employment and scheduling flexibilities that offer appealing work conditions for a continued influx of female professionals. Furthermore, the increased role of pharmacists as consultants to physicians and the general public regarding use of drugs also may appeal to greater numbers of young people interested in this aspect of health and in the general functioning of our society.

In accordance with some of these considerations, the basic methodology used here projects an increase in the supply of active female pharmacists from 11,700 in 1970 to 20,700 in 1980 and 35,200 in 1990. In effect, the supply of female pharmacists is projected to triple over the next two decades, increasing the proportion of all active pharmacists accounted for by females from 9.0 percent in 1970 to 19.6 percent by 1990.

VETERINARIANS, OPTOMETRISTS, PODIATRISTS

Among the remaining health professions, the greatest relative increases in supply are anticipated for veterinarians. Compared with a 31-percent growth in supply during the 1960's, the supply of these professionals is projected to grow by 41 percent during the 1970's and 32 percent during the 1980's. By 1990, the supply of active veterinarians is projected to reach 48,100, an 86-percent increase over the 25,900 active supply in 1970. The supply of optometrists is projected to increase from 18,400 in 1970 to 28,000 in 1990, somewhat more rapidly than during the 1960-70 period. For podiatrists, the supply is projected to grow rapidly, increasing from 7,100 in 1970 to 13,000 in 1990. The ratio to population for both optometrists and podiatrists will rise substantially.

ALTERNATIVE PROJECTIONS

In addition to the projection for health professionals utilizing the basic methodology, a number of alternative projections were developed for several professions that reflected different educational responses to the basic assumption that underlay the projections. Although the basic assumption was that enrollment resulting from current legislation would at least be maintained through the projection period, it was further assumed that, given these enrollment levels as a base, additional increases might occur in the absence of Federal funding specifically targeted at increasing enrollment. The basic methodology, consequently, assumed that any further enrollment increases or construction of new schools could be approximated by the experience of the respective professional schools prior to the initiation of massive Federal legislation. For a number of occupations, consequently, alternative projections were developed that assumed either (a) an absence of further enrollment growth after 1974-75 or (b) a growth pattern after 1974-75 that exceeded the gains experienced prior to the legislative impact yet remained at a pace below that evidenced during the time when Federal legislation apparently exerted its greatest impact.

Two alternative projections were developed for the overall supply of physicians, for example. Compared to the basic supply projection for physicians discussed above (593,800 in 1990), the "high" projection showed an estimate of 637,100 for 1990, while a "low" projection resulted in a supply projection of 552,000 for that year. The divergence in the supply estimates projected by these alternatives, consequently, would be about 85,000 by 1990, with the "low" or most conservative estimate being about 15 percent below the "high" projected figure.

The variation in these supply figures reflects, in part, differences in the number of projected first-year enrollees in U.S. medical and osteopathic schools, which result in corresponding differences among the number of graduates projected. The basic methodology projects, for example, a total gross graduate input (before deaths and retirements) of 268,083 M.D. graduates over the projection period; the low alternative projects a total input of 253,237, the high alternative projects an input of 284,496. In brief, the variations in domestic production of physicians, as projected, account for somewhat more than one-third of the 85,000 difference in supply (1990) shown by the low and high alternatives. Variations in the projected growth pattern of the FMG population account for the remainder and the bulk of the difference.

As indicated earlier, the basic methodology projects the number of active foreign-trained physicians in the United States to rise from about 60,000 in 1970 to 164,000 by 1990, an increase of 173 percent or about 8 percent annually (compounded). The high and low alternatives project a 1990 active supply of FMG's of 191,000 and 137,000 respectively. Even under the conservative alternative, significant growth in the FMG population is projected—more than doubling over the next two decades.

Physicians represent the only health professional group in this report for which alternative projections were undertaken for two segments of the professional population—namely, U.S. medical and osteopathic school graduates and the FMG population. A total of nine combinations of alternate projections can be shown. In this report, the low alternative shown represents the combination of low projections for both segments of the physician population; the high alternative represents, correspondingly, a combination of the two high projections. (See Table 7.) No additional analysis has been undertaken concerning the other possible combinations.

Considerations used in developing these alternative projections for physicians and for other health professional groups, as well as comparative findings, are presented in greater detail in subsequent chapters.

In summary, the overall projections developed for health professions show a sharp expansion in the supply of these groups over the 1970-90 period, generally at a more rapid pace than during the 1960 decade. These projections, however, are contingent upon the basic assumption about productive capacity advanced earlier. Actual growth patterns could vary considerably from the projections shown if the aggregate level and composition of support in the coming years were to be substantially different from that assumed in this report.

Table 7.

ALTERNATIVE PROJECTIONS OF THE SUPPLY OF ACTIVE PHYSICIANS (M.D. AND D.O.) IN THE UNITED STATES: 1990

Type of alternative projection of physicians		Projected number of active physicians (M.D. and D.O.)
Trained in the United States	Foreign trained[1]	
Low	Low	[2] 552,000
Low	Basic	578,600
Low	High	605,200
Basic	Low	567,200
Basic	Basic	[2] 593,800
Basic	High	620,400
High	Low	583,900
High	Basic	610,500
High	High	[2] 637,100

[1] Includes physicians trained in Canada.
[2] Represents projections shown and discussed in this report.

SUPPLY OF ALLIED HEALTH PERSONNEL

Among allied health professions and occupations, the supply projections developed for this report utilize as estimates of future entrants into the supply only graduates of approved programs. This reflects the fact that data available on the training of allied health workers are extremely sparse and limited to only a few occupations. Furthermore, in only a relatively small number of allied health fields are all or most workers formally trained in educational institutions. In order to assess fully the meaning of the projections of allied health workers, it will be necessary to determine what additional supply will result from those entering the field from other than approved programs. Such supply projections are now being developed by BHRD.

Projections of allied health manpower supply have been developed in this report for 16 occupational groups, generally those where information on supply, graduates, and training programs is available and reasonably reliable. *It should be noted by the reader, however, that these projections were developed for the active supply of formally trained persons in the respective allied health professions and occupations, not for the total supply of workers.* In all of the projections (as summarized in Table 8), the initial starting supply point in 1970 represented the best estimate available of the active credentialed work force. Over the projection period, subsequently, additions to the work force consisted only of graduates of approved programs.

The rationale for this approach was partly based on the current inadequacies in the data base for allied health manpower which, in turn, precluded what could be considered meaningful projections of the total supply, including persons now in the work force and future entrants into these occupations who have not gained entrance through formal training. This approach, in view of the growing trend in many occupations to have formal training as a minimum requirement for entrance, permitted an examination of current and future profiles for those persons who had received or were projected to obtain formal training.

Given such considerations, nonetheless, the projections for these selected allied health occupations did reveal considerable variation in growth patterns. This is illustrated in Table 8 and presented in greater detail in Chapter 11.

* * * * * *

The overall findings presented above for health professions and allied health projections provide a brief overview of the material presented in this report. Detailed information, and additional background data, are provided in the following chapters.

Table 8.

SUPPLY OF ACTIVE FORMALLY TRAINED SELECTED ALLIED HEALTH PERSONNEL: 1970 AND PROJECTED 1975-90

Occupation	1970	1975	1980	1985	1990
	Basic educational preparation at least baccalaureate in level				
Dietitians	15,300	16,140	18,170	20,470	22,340
Medical record administrators	4,200	4,500	5,140	5,850	6,430
Medical technologists	45,000	60,160	80,620	103,010	123,520
Occupational therapists	7,300	9,270	11,760	14,500	16,880
Physical therapists	11,550	16,640	23,030	30,080	36,570
Speech pathologists and audiologists	13,300	23,560	37,070	53,720	70,930
	Basic educational preparation less than baccalaureate in level				
Certified laboratory assistants	6,700	13,590	22,260	31,950	41,160
Cytotechnologists	2,400	3,400	4,670	6,090	7,400
Dental assistants	9,200	23,490	39,110	55,880	71,530
Dental hygienists	15,100	23,310	34,190	46,320	57,650
Dental laboratory technicians	1,600	3,970	7,070	10,670	14,290
Respiratory therapists	3,850	6,800	10,510	14,720	18,810
Licensed practical nurses	400,000	464,680	565,890	693,410	819,790
Medical record technicians	3,800	4,160	4,900	5,720	6,460
Occupational therapy assistants	600	2,320	4,360	6,620	8,820
Radiologic technologists	41,000	63,570	93,560	127,770	161,280

Source: 1970 dental allied: BHRD, Division of Dental Health
1970 all other occupations: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. 72-1509. U.S. Government Printing Office, 1972.

Note: These estimates are for the supply of formally trained personnel only, and consequently should not be viewed as representing total active supply. Additions to 1970 supply include only graduates of approved programs.

PART II
DETAILED OCCUPATIONAL PROFILES

Chapter 3 PHYSICIANS

This chapter provides a wide variety of information—current, historical, and projected—on physicians in the United States. It describes current characteristics and trends, as well as projections of the total supply of physicians. Also included are data sources used, a discussion of the assumptions and methodology used in developing the projections, and an analysis of the projection findings.

The data on physicians (M.D.), largely drawn from data published by the American Medical Association (AMA), generally cover all active non-Federal physicians in the 50 States, the District of Columbia, Puerto Rico, and other outlying areas of the United States, as well as Federal physicians in the United States and abroad. Excluded from coverage are inactive physicians, those with address unknown, and those identified as "temporarily foreign."

The American Osteopathic Association (AOA), which maintains a master file of osteopathic physicians in the United States, is the source of all primary data descriptive of the osteopathic physician population. The AOA file was recently updated on the basis of a survey of osteopathic physicians conducted by the AOA in June 1971. While preliminary data are available, the results from the survey are not included in this report, since further analysis will be required before using the data. Therefore, 1970 characteristics data shown in this report for osteopathic physicians have been estimated on the basis of distributions observed in 1967.

There is probably more extensive and better quality information on the M.D. population than on any other health profession. There are, however, a number of problems in utilizing the historical data on M.D.'s. In the early 1960's, the AMA made a major effort to improve its data on the M.D. population, including changes in definitions and coverage which created discontinuities in the statistics. Among significant changes made by the AMA were: (1) a shift of the annual reference point from mid-year to year-end; (2) omission of non-Federal physicians with temporary foreign addresses from tabulations of physician data; (3) the inclusion of foreign-trained physicians taking internship or residency training in the United States, without regard to the physician's intention to remain here after completing training; and (4) inclusion of unlicensed foreign-trained physicians identified for the first time when they obtained standard certificates from the Education Council for Foreign Medical Graduates.[1]

In 1968, furthermore, the AMA made several major changes in its classification system and questionnaire format which substantially affected the activity and specialty classification of physicians and created a discontinuity in the historical series of M.D.'s between 1967 and 1968. Although the data on M.D.'s as a whole remained relatively consistent over this period, there was discontinuity for active M.D.'s. Under the new classification system, the identification of inactive physicians became a priority. Largely reflecting the definitional change, as well as the impact of improved and computerized record keeping, the number of physicians listed as inactive rose from 13,000 in 1967 to 19,000 in 1968. Significant changes are also apparent in the "not classified" category in 1970 through 1972. In 1970 this category represented only 0.1 percent of all physicians, but in 1972 it increased to 3.5 percent. This anomaly is due largely to the high nonresponse rate to recent AMA procedures to update its files. Further information on the effects of these changes is given in subsequent sections of this report.

These problems notwithstanding, the historical coverage of the M.D. population is considerably more extensive than that of osteopathic physicians. Historical data for D.O.'s are very limited, and the figures shown here are largely estimates. In order to provide an improved data base on D.O.'s, the Bureau of Health Resources Development (BHRD) has contracted with the American Osteopathic Association to process the data from its 1971 survey of osteopathic physicians.

Efforts are also being undertaken by BHRD to gain further insights into the supply profile of the M.D. population. For example, BHRD is currently exploring a number of alternative approaches to improving and expanding the current data base on foreign-trained physicians. As indicated later in this chapter, the limited statistical information now available for this group represents perhaps the most significant and critical gap in the information system on physicians. Furthermore, BHRD is currently engaged in a number of contracts to provide additional supply, requirements, and utilization information for selected specialties.

CURRENT CHARACTERISTICS AND TRENDS

There were approximately 323,200 physicians—311,200 M.D.'s and 12,000 D.O.'s—actively engaged in medical practice in the United States as of December 31, 1970. About 54 percent of all active physicians were under 45 years of age, according to estimates based on 1967 AMA data. (See Table 9.) Thus, at least one-half of the active

[1] A detailed discussion of these modifications and the reasons for them appears in: Pennell, Maryland Y. Statistics on Physicians, 1950-63. *Public Health Reports* 79: 905-910, October 1964.

Table 9.

NUMBER OF ACTIVE PHYSICIANS (M.D. AND D.O.), BY AGE GROUP AND SEX: DECEMBER 31, 1970

Age group	Both sexes		Male		Female	
	Number	Percent distribution	Number	Percent distribution	Number	Percent distribution
All ages	323,200	100.0	301,000	100.0	22,200	100.0
25-44 years	173,340	53.6	160,090	53.2	13,260	59.9
25-29[1]	37,980	11.8	33,910	11.3	4,070	18.4
30-34	46,360	14.3	43,130	14.3	3,230	14.6
35-39	44,970	13.9	42,110	14.0	2,850	12.9
40-44	44,040	13.6	40,930	13.6	3,110	14.0
45-64 years	120,200	37.2	113,120	37.6	7,080	31.9
45-49	38,440	11.9	35,940	11.9	2,500	11.3
50-54	31,650	9.8	29,700	9.9	1,960	8.8
55-59	28,560	8.8	27,070	9.0	1,500	6.7
60-64	21,540	6.7	20,420	6.8	1,120	5.1
65 years and over	29,660	9.2	27,830	9.2	1,830	8.3
65-69	13,880	4.3	13,010	4.3	870	3.9
70-74	8,130	2.5	7,560	2.5	570	2.6
75 and over	7,650	2.4	7,260	2.4	390	1.8

[1] Includes all those reported as "under 30 years of age".

Source: Female physicians: Based on percent of women among active M.D's as shown in: Pennell, Maryland Y. and Renshaw, Josephine E. Distribution of Women Physicians, 1970. *Journal American Medical Women's Association* 27: 197-203, April 1972.
Age distribution of physicians: Based on 1967 age distribution of active M.D.'s as shown in: Theodore, C. N. and Haug, J. N. *Selected Characteristics of the Physician Population, 1963 and 1967.* Chicago, American Medical Association, 1968.

Note: Figures may not add to totals and subtotals due to independent rounding.
Preliminary data from the 1971 American Osteopathic Association Survey of Osteopathic Physicians suggest that active osteopaths are somewhat older than active M.D.'s.

physician supply in 1970 was accounted for by those who graduated during the past two decades. Among the youngest age groups, a considerably larger percentage of female physicians (one-third) were under the age of 35 than were male physicians (one-fourth). Looked at in another way, nearly half of all physicians were 45 years of age or over in 1970, and nearly all of these physicians will have left the profession through death or retirement by 1990.

Female physicians accounted for 6.9 percent (or 22,200) of the total active supply in 1970.[2] Although this proportion was up slightly from 1967 (5.7 percent), recent developments in medical school enrollment suggest sharper increases in female representation in coming years. For example, in 1968-69, women accounted for 9.1 percent of the total first-year enrollments in U.S. medical schools; in 1969-70, 9.3 percent; in 1970-71, 11.1 percent; and in 1971-72, 13.5 percent.[3]

According to the 1970 Census of Population[4], Blacks accounted for 2.2 percent of the physician supply in 1970; and M.D.'s of Spanish heritage accounted for about 3.7 percent. Although current information on the racial-ethnic composition of physicians is generally rather limited, data

[2] It should be noted, however, that according to the 1970 Census of Population, 9.2 percent of physicians were female. The discrepancy in these figures might, in part, be accounted for by (1) the standard errors inherent to proportions from a sample, as is the case in both the figures in Table 9 and the 1970 census results, (2) the general mobility of females in and out of the labor force and most important, (3) the fact that the Table 9 figure is based on a stringent AMA classification of activity (new classification), where Census data rely on self-reporting.

[3] Dubé, W. F. U.S. Medical Student Enrollments, 1968-69 through 1972-73. *Journal of Medical Education* 48: 293-297, March 1973.

[4] U.S. Bureau of the Census. *United States Census of Population: 1970. Detailed Characteristics.* United States Summary. PC(1)-D1. U.S. Government Printing Office, 1973.

from the Current Population Survey (CPS) indicate that the representation of Black and other minority groups was about 8 percent in 1970.[5] It should be recognized, however, that CPS definitions of racial-ethnic groups are not totally consistent with Census classifications; furthermore, separate data on Black representation are not available from the survey.

To remedy this lack of racial-ethnic data, BHRD has contracted with the National Medical Association Foundation, Inc., to conduct a survey of Black physicians. This survey is shortly expected to provide data on the geographic distribution, types of practice, specialties, and other professional and personal characteristics of Black physicians in the United States.

The number of Black physicians more than likely will soon be increasing, since Black enrollments in medical schools have been rising in the past few years. In the 1968-69 academic year, Blacks accounted for 2.7 percent of first-year enrollment; in 1969-70, for 4.2 percent. Other minorities, such as Orientals and Puerto Ricans, have also shown small increases in enrollment in recent years, and two very underrepresented minorities—Mexican-Americans and American Indians—have shown relatively sharp increases, though their total representation continues to be virtually negligible.[6]

Among the Nation's geographic regions, physicians are disproportionately located in the Northeast and West, areas that have ratios of active physicians per 100,000 population significantly above those in the South and North Central States. On a geographic division basis, physician/population ratios in 1970 ranged from 196 and 190 per 100,000 population in the Middle Atlantic and New England States respectively, to 132 and 105 per 100,000 population in the West South Central and East South Central States, respectively. Individual State ratios ranged from a high of 236 per 100,000 population in New York, to a low of 89 per 100,000 population in Mississippi. (See Table 10.)

This geographic pattern largely reflects the continued movement of physicians to States having large urbanized areas. For example, although physicians were underrepresented in the South, the physician/population ratio for the South Atlantic States was virtually at the national average in 1970—largely resulting from heavy physician concentrations in the District of Columbia and Maryland (Baltimore). Of the 10 States with the largest number of cities with populations over 100,000 in 1970, furthermore, only one State (Indiana) had a physician/population ratio lower than the median ratio for all States (134 per 100,000 population).

Contributing to this development has been the rapidly increasing demand for physician services in large metropolitan areas, as well as the greater attraction presented to physicians to practice in urban rather than rural settings. To some extent, the locational patterns of physicians appear to reflect the distribution of medical schools in the Nation. More significantly, however, available evidence suggests strongly that State of practice tends to be related to State of internship and residency. These training programs tend to be concentrated in metropolitan areas, where facilities are generally more adequate to further educate large numbers of doctors.

The geographic distribution of osteopathic physicians differs somewhat from that of M.D.'s. In 1970, for example, ratios among regions ranged from 3.3 per 100,000 population in the Southern region to 9.6 per 100,000 population in the North Central region. In contrast to M.D.'s, it has only been during the last decade that virtually all States have begun to license D.O.'s for unlimited practice, a situation that is partially responsible for the current skewed geographic distribution of D.O.'s. Preliminary AOA survey results indicate that at the end of 1971, two-thirds of all active non-Federal osteopathic physicians were located in the East North Central, West North Central, and Middle Atlantic divisions. The largest concentration of active D.O.'s in the Federal service was located in the North Central region.

Direct care of patients is the primary activity of the overwhelming proportion of physicians. As of December 31, 1970, 290,300 physicians (or 90 percent of all active physicians) were involved in the direct care of patients as their primary activity. (See Table 11.) About two-thirds of all active physicians were in office-based practice (203,200), while slightly less than one-third (87,100) were in hospital-based practice. Of this latter group, 52,000 were interns or residents. The remaining active physicians were engaged in administration (12,200), research (11,900), medical teaching (5,700), and other activities (2,700). Of physicians in patient care, 70 percent were in office-based practice.

Over 98 percent of the active osteopathic physicians have patient care as their primary activity, with the remaining 1 percent recorded in teaching. About 90 percent were in office-based practice and 9 percent in hospital-based activity.

As explained earlier, the American Medical Association recently introduced new criteria for establishing a physicians's primary activity. The physician no longer merely indicates his primary activity, but rather reports the average number of hours worked during a typical week in each activity. The primary activity is defined (and assigned by computers) as that in which the physician indicates that he spends the greatest number of hours.

[5] Unpublished data from the *Current Population Survey* of the Bureau of Labor Statistics, U.S. Department of Labor.

[6] Dubé, *op. cit.*

Table 10.

NUMBER OF ACTIVE PHYSICIANS (M.D. AND D.O.) AND PHYSICIAN/POPULATION RATIOS, BY GEOGRAPHIC REGION, DIVISION, AND STATE: DECEMBER 31, 1970

Region, division, and State	Number of active physicians	Resident population July 1, 1970 (in 1,000's)	Number of physicians per 100,000 population	Number of active M.D.'s	Number of active D.O.'s
All locations	323,200	209,539	154	311,200	12,000
UNITED STATES	317,200	203,805	156	305,300	12,000
NORTHEAST	95,730	49,150	195	92,520	3,210
New England	22,530	11,873	190	21,940	590
Connecticut	5,730	3,039	189	5,690	50
Maine	1,240	995	125	1,060	180
Massachusetts	12,120	5,699	213	11,890	240
New Hampshire	1,010	742	136	990	20
Rhode Island	1,600	951	169	1,530	80
Vermont	820	447	184	790	30
Middle Atlantic	73,210	37,272	196	70,580	2,630
New Jersey	10,900	7,195	152	10,300	600
New York	43,080	18,260	236	42,560	520
Pennsylvania	19,270	11,817	163	17,720	1,510
SOUTH	83,750	62,990	133	81,630	2,110
South Atlantic	45,690	30,773	149	44,880	810
Delaware	780	550	141	740	40
District of Columbia	3,950	753	525	3,940	20
Florida	9,980	6,845	146	9,490	480
Georgia	5,360	4,602	117	5,280	80
Maryland	9,150	3,937	232	9,130	20
North Carolina	5,790	5,091	114	5,760	30
South Carolina	2,520	2,596	97	2,520	10
Virginia	6,240	4,653	134	6,200	40
West Virginia	1,930	1,746	111	1,830	100
East South Central	13,460	12,823	105	13,370	90
Alabama	3,200	3,451	93	3,200	0
Kentucky	3,440	3,224	107	3,410	40
Mississippi	1,970	2,216	89	1,970	0
Tennessee	4,850	3,932	123	4,800	60
West South Central	24,590	19,396	132	23,380	1,210
Arkansas	1,830	1,926	95	1,820	20
Louisiana	4,600	3,644	126	4,590	10
Oklahoma	3,140	2,572	122	2,730	410
Texas	15,030	11,254	134	14,250	780
NORTH CENTRAL	76,500	56,730	135	71,060	5,440
East North Central	54,430	40,368	135	50,730	3,700
Illinois	15,770	11,137	142	15,490	280
Indiana	5,360	5,208	103	5,180	180
Michigan	12,810	8,901	144	10,770	2,040
Ohio	15,060	10,688	141	14,020	1,040
Wisconsin	5,430	4,433	123	5,270	160

Table 10.

NUMBER OF ACTIVE PHYSICIANS (M.D. AND D.O.) AND PHYSICIAN/POPULATION RATIOS, BY GEOGRAPHIC REGION, DIVISION, AND STATE: DECEMBER 31, 1970—Continued

Region, division, and State	Number of active physicians	Resident population July 1, 1970 (in 1,000's)	Number of physicians per 1,000 population	Number of active M.D.'s	Number of active D.O.'s
NORTH CENTRAL—Continued					
West North Central	22,070	16,367	135	20,340	1,740
Iowa	3,260	2,830	115	2,880	380
Kansas	2,910	2,248	129	2,740	180
Minnesota	5,860	3,822	153	5,810	50
Missouri	7,020	4,693	150	5,970	1,050
Nebraska	1,760	1,490	118	1,730	40
North Dakota	630	618	102	620	10
South Dakota	630	666	95	600	30
WEST	61,330	34,930	176	60,090	1,230
Mountain	12,550	8,345	150	11,840	710
Arizona	2,860	1,792	160	2,610	250
Colorado	4,380	2,225	197	4,140	240
Idaho	700	717	97	670	30
Montana	770	697	111	740	30
Nevada	570	493	116	550	30
New Mexico	1,420	1,018	139	1,300	120
Utah	1,500	1,069	141	1,480	20
Wyoming	350	334	103	340	10
Pacific	49,780	26,589	183	48,260	520
Alaska	320	305	106	320	0
California	38,780	19,994	194	38,590	190
Hawaii	1,170	774	151	1,150	20
Oregon	3,105	2,102	148	2,960	140
Washington	5,400	3,414	158	5,240	170
Puerto Rico	2,480	–	–	2,480	–
Outlying areas	3,420	–	–	3,420	–

Sources: M.D.'s: Haug, J. N.; Roback, G. A.; and Martin, B. C. *Distribution of Physicians in the United States, 1970.* Chicago, American Medical Association, 1971.

D.O.'s: Based on data in: American Osteopathic Association. *A Statistical Study of the Osteopathic Profession, 1967.* Chicago, The Association, 1968.

Population: U.S. Bureau of the Census. Current Population Reports. Series P-25, No. 468.

Note: Figures may not add to totals and subtotals due to independent rounding.

According to the AMA, the impact of the reclassification has been greatest (in percentage terms) upon the medical teaching component, as many physicians on medical school staffs spend more time in nonteaching functions (e.g., research or patient care) than they do in teaching. Thus, in 1970, the AMA reported approximately 5,600 physicians primarily engaged in medical teaching; whereas for the same year, the Association of American Medical Colleges (AAMC) reported 16,100 M.D.'s holding full-time faculty positions in American medical schools.

Overall, the number of active physicians in the United States has increased substantially in the past two decades, rising from 219,900 in 1950, to 251,900 in 1960 and to 323,200 in 1970, an increase of approximately 47 percent over the 20-year period. (See Table 12.) It should be noted, however, that these figures understate slightly the growth of active physicians, because of the change in the AMA classification system in 1968. Although the number of inactive physicians was fairly constant since the early 1960's, a change in definition used by the AMA in 1968

Table 11.

NUMBER OF ACTIVE PHYSICIANS (M.D. AND D.O.), BY MAJOR PROFESSIONAL ACTIVITY: DECEMBER 31, 1970

Major professional activity	Total active physicians		M.D.		D.O.	
	Number	Percent distribution	Number	Percent distribution	Number	Percent distribution
All activities	323,200	100.0	311,200	100.0	12,000	100.0
Patient care	290,300	89.8	278,500	89.5	11,800	98.3
Office based	203,200	62.9	192,400	61.8	10,800	89.8
Hospital based	87,100	27.0	86,100	27.7	1,000	8.5
Interns	11,900	3.7	11,400	3.7	400	3.5
Residents	40,100	12.4	39,800	12.8	400	2.9
Full-time staff	35,100	10.9	34,900	11.2	200	1.8
Medical teaching	5,700	1.8	5,600	1.8	100	1.1
Administration	12,200	3.8	12,200	3.9	(1)	–
Research	11,000	3.7	11,900	3.8	0	–
Other	2,700	0.8	2,600	0.9	(1)	–
Not classified	400	0.1	400	0.1	0	–

[1] Less than 50.

Source: M.D.'s: Haug, J. N.; Roback, G. A.; and Martin, B. C. *Distribution of Physicians in the United States, 1970.* Chicago, American Medical Association, 1971.
D.O.'s: Based on data in: American Osteopathic Association. *A Statistical Study of the Osteopathic Profession, 1967.* Chicago, The Association, 1968.

Note: Similar data for M.D.'s for 1972 appear in Appendix C, table C2.
Figures may not add to totals and subtotals due to independent rounding.

resulted in raising its count of inactive physicians by about 6,000 between 1967 and 1968.

As indicated above, the growth of the overall physician supply has been especially rapid since the mid-1960's. Blumberg estimates that about half of the gain from 1966 to 1970 reflected the moderate increase in enrollment in U.S. medical schools beginning in the fall of 1960.[7] The remainder of the increase was largely accounted for by the continued entry of foreign-trained physicians into the U.S. supply.

Increases in medical school enrollments in recent years give clear indications of continuing sharp increases in physician supply in the years ahead. In the last decade, total student enrollment in U.S. medical and osteopathic schools rose about one-third, from 32,232 in academic year 1960-61 to 42,638 in 1970-71. Reflecting the impact of health manpower legislation since the mid-1960's, enrollment growth has been especially rapid in recent years. Among medical schools, for example, first-year enrollment in academic year 1971-72 numbered 12,361, a 49 percent rise over first-year enrollment in 1960-61. Between 1966-67 and 1971-72, furthermore, the number of U.S. medical schools rose from 89 to 108, as compared with a total of 86 medical schools in 1960. (See Table 13.)

FOREIGN MEDICAL GRADUATES

About one out of every six M.D.'s in the United States is a foreign medical graduate (FMG).[8] There were 54,418 active FMG's in the United States as of December 1970, representing the medical schools of 84 foreign countries.

[7] Blumberg, Mark S. *Trends and Projections of Physicians in the United States, 1967-2002.* Berkeley, Calif. Carnegie Commission on Higher Education, 1971.

[8] In this section of the chapter, "FMG's" do not include Canadian trained physicians, unless otherwise stated. See footnote 1 in Chapter 2.

Table 12.

TREND IN NUMBER OF ACTIVE PHYSICIANS (M.D. AND D.O.) AND PHYSICIAN/POPULATION RATIOS: SELECTED YEARS DECEMBER 31, 1950-72

Year	Number of active physicians[1]	Total population[2] (in 1,000's)	Active physicians per 100,000 population	Number of active M.D.'s	Number of active D.O.'s[3]
1950	219,897	156,472	141	208,997	10,900
1955	240,153	170,499	141	228,553	11,600
1960	251,933	185,370	136	239,757	12,176
1961	259,267	188,303	138	246,689	12,578
1962	264,947	191,236	139	254,316	10,631
1963	272,502	194,169	140	261,728	10,772
1964	280,461	196,858	142	269,552	10,909
1965	288,671	199,278	145	277,575	11,096
1966	297,097	201,585	147	285,857	11,240
1967	305,453	203,704	150	294,072	11,381
1968	307,882	205,758	150	296,312	11,570
1969	314,706	207,863	151	302,966	11,740
1970	323,203	209,539	154	311,203	12,000
1971	N.A.	–	N.A.	[4] (318,699)	N.A.
1972	N.A.	–	N.A.	[5] (320,903)	N.A.

[1] Excludes physicians with address unknown and those with activity status not reported.

[2] Includes civilians in 50 States, District of Columbia, Puerto Rico, and other outlying areas; U.S. citizens in foreign countries; and the Armed Forces in the U.S. and abroad.

[3] The decline in the number of active D.O.'s between 1961 and 1962 reflects the granting of some 2,400 M.D. degrees to osteopathic physicians who had graduated from the University of California College of Medicine at Irvine when it was the College of Osteopathic Physicians and Surgeons. These physicians are included in the count of M.D.'s beginning in 1962.

[4] Excludes 3,529 physicians "not classified". If the percent active among all physicians is applied to the "not classified" physicians, the estimated number of active physicians would be 322,026.

[5] Excludes 12,356 physicians "not classified". If the percent active among all physicians is applied to the "not classified" physicians, the estimated number of active physicians would be 332,530.

Source: All data for 1950, 1955; population for 1960-70: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

1960-62 active physicians: Pennell, Maryland Y. Statistics on Physicians, 1950-63. *Public Health Reports* 79: 905-910, October 1964.

1963-67 active D.O.'s: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1968.* Public Health Service Pub. No. 1509. U.S. Government Printing Office, 1968.

1963-72 active M.D.'s: Roback, G. A. *Distribution of Physicians in the U.S., 1972.* Chicago, American Medical Association, 1973. Also prior annual editions.

1968, 1969 active D.O.'s: Interpolated by BHRD, Division of Manpower Intelligence.

1970 active D.O.'s: Unpublished data provided by the American Osteopathic Association.

This group comprised 17.5 percent of the active M.D. population. In addition, active Canadian graduates in the United States numbered 5,539, or 1.8 percent of the active M.D. population.

Historical data on total active FMG's are very limited. Data on the total numbers are available for a number of years, but detailed data on age, sex, activity, and State of practice are available for only a few years. Where possible, data on *active* FMG's are presented here, although many of the characteristics data refer only to the *total* group—active, inactive, and address unknown. (A more detailed discussion of these and other weaknesses of the data on FMG's is presented in the section on projections.)

According to the limited data available, the FMG population in the United States has expanded at a rapid rate in recent years, while the number of Canadian

Table 13.

TREND IN NUMBER OF SCHOOLS, ENROLLMENTS, AND GRADUATES FOR MEDICAL AND OSTEOPATHIC SCHOOLS: ACADEMIC YEARS 1960-61 THROUGH 1971-72

Academic year	Medical schools				Osteopathic schools			
	Number of schools	Total enrollment	First-year enrollment	Graduates	Number of schools	Total enrollment	First-year enrollment	Graduates
1960-61	86	30,288	8,298	6,994	6	1,944	496	506
1961-62[1]	87	31,078	8,483	7,168	5	1,555	439	363
1962-63	87	31,491	8,642	7,264	5	1,581	433	367
1963-64	87	32,001	8,772	7,336	5	1,594	441	355
1964-65	88	32,428	8,856	7,409	5	1,661	472	394
1965-66	88	32,835	8,759	7,574	5	1,681	464	360
1966-67	89	33,423	8,964	7,743	5	1,763	480	405
1967-68	94	34,538	9,479	7,973	5	1,823	509	427
1968-69	99	35,833	9,863	8,059	5	1,879	521	427
1969-70	101	37,669	10,401	8,367	6	1,997	577	432
1970-71	103	40,487	11,348	8,974	7	2,151	623	472
1971-72	108	43,650	12,361	9,551	7	2,304	670	485

[1] College of Osteopathic Physicians and Surgeons in Los Angeles became the University of California College of Medicine at Irvine in 1961-62. The latter school granted its first M.D. degrees to senior students who were to graduate in June 1962.

Source: Medical schools: Medical Education in the United States, 1971-72. *Journal of the American Medical Association* 222: 961-1076, Nov. 20, 1972.
Osteopathic schools: American Osteopathic Association, Office of Education. *Educational Supplement March 1973.* Also prior annual editions.

graduates has remained relatively stable. As of December 31, 1963, there were 30,925 FMG's in the United States, comprising approximately one-ninth of the total M.D. population. By December 31, 1970, the number of FMG's had almost doubled, to approximately one-sixth of the total M.D. population. This near-doubling of FMG's contrasts sharply with the 13 percent increase in U.S. trained M.D.'s and a 9 percent increase in Canadian trained M.D.'s between 1963 and 1970. By December 31, 1972, the number and percentage of FMG's had risen even further. (See Table 14.)

The rapid increase in total FMG's in recent years is further illustrated by the increases in annual FMG immigrants and exchange visitors, FMG licensure, and FMG-filled internships and residencies. In FY 1963, FMG immigrants and exchange visitors totaled 6,739[9]; by FY 1972, the number had risen by 65 percent to 11,080. Similarly, the annual number of newly licensed FMG's has risen rapidly, from 1,451 in 1963 to 3,016 in 1970, or from one-sixth to one-fourth of the total new licentiates. By 1972, the number had risen to 6,661 or nearly one-half of all newly licensed additions to the medical profession.[10] About one-half of the FMG's in the United States were fully licensed as of December 31, 1970.[11]

The growing proportion of internships and residencies being filled by FMG's also serves to illustrate the rising importance of this group. In 1962-63, 19 percent of all interns were FMG's; by 1970-71, the proportion was 35 percent. Residencies filled by foreign medical graduates increased from 24 percent of the total in 1962-63 to 32 percent in 1972-73.

Almost two-fifths of all FMG's in the United States in 1970 had graduated from medical schools located in Europe, while one-third had graduated from schools in Asia. (See Table 15.) Over 60 percent of all FMG's in the

[9] Stevens, Rosemary and Vermeulen, Joan. *Foreign Trained Physicians and American Medicine.* DHEW Pub. No. (NIH) 73-325. U.S. Government Printing Office, 1972.

[10] American Medical Association, Council on Medical Education. Medical Licensure 1972. *Journal of the American Medical Association* 225:299-310, July 16, 1973.

[11] There were wide variations among States in the proportion of FMG's who were licensed. For example, more than two-thirds of the FMG's in California were licensed, the largest percentage of licensed FMG's in any State. This compares with only 6 percent in Louisiana.

Table 14.

TREND IN SUPPLY OF TOTAL PHYSICIANS (M.D. AND D.O.) IN UNITED STATES, BY COUNTRY OF GRADUATION: SELECTED YEARS DECEMBER 31, 1959-72

Year	Total physicians[1]	United States trained	Canadian trained	Other foreign trained	
				Number	Percent of total physicians
1959	255,170	234,595	5,421	15,154	5.9
1963	289,188	252,619	5,644	30,925	10.7
1967	322,045	270,179	6,050	45,816	14.2
1969	338,942	N.A.	N.A.	53,552	15.8
1970	348,328	284,937	6,174	57,217	16.4
1971	359,373	290,923	[2] 6,236	62,214	17.3
1972	N.A.	N.A.	N.A.	68,009	–

[1] Includes both active and inactive physicians.
[2] Unpublished data from the American Medical Association.

Source: M.D.'s 1959: Stewart, William H. and Pennell, Maryland Y. *Health Manpower Source Book 11. Medical School Alumni.* U.S. Government Printing Office, 1961.
M.D.'s 1963, 1967: Theodore, C. N. and Haug, J. N. *Selected Characteristics of the Physician Population, 1963 and 1967.* Chicago, American Medical Association, 1968.
M.D.'s 1969-72: American Medical Association. *Profile of Medical Practice.* 1973 and prior annual editions. Chicago, The Association, 1973.
D.O.'s 1959, 1971: Estimated by BHRD, Division of Manpower Intelligence.
D.O.'s 1963-70: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table 15.

NUMBER OF FOREIGN-TRAINED PHYSICIANS (M.D.) IN THE UNITED STATES, BY GEOGRAPHIC REGION OF GRADUATION: DECEMBER 31, 1970

Region of graduation	Number[1]	Percent distribution
All regions	63,400	100.0
Africa	1,130	1.8
Asia	21,000	33.1
Canada	6,170	9.7
Europe	24,760	39.1
Latin America	9,930	15.7
Oceania	400	0.6

[1] Includes both active and inactive physicians.

Source: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association. 1971.

NOTE: Figures may not add due to independent rounding.

same year were from 13 countries: Philippines, India, West Germany, Italy, Cuba, United Kingdom, Switzerland, South Korea, Mexico, Spain, Austria, Argentina, and Iran. (See Table 16.) Although about half the FMG's were from developed countries, there has been a substantial increase in recent years in the number of FMG's coming from the developing countries. The latter tend to be more recent graduates than those from the developed countries. As of 1970, approximately 60 percent of the FMG's from developed countries had graduated prior to 1955. But a vast

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Table 16.

PERCENT DISTRIBUTION OF FOREIGN-TRAINED PHYSICIANS (M.D.) IN THE UNITED STATES FOR SELECTED COUNTRIES OF GRADUATION: 1967 and 1969-72

Country of graduation	1967	1969	1970	1971	1972
All countries (excluding Canada):					
Number[1]	46,300	53,600	57,200	62,200	68,000
Percent	100.0	100.0	100.0	100.0	100.0
Philippines	12.8	12.8	12.7	12.8	13.0
India	8.2	6.9	6.8	5.1	9.3
West Germany	5.6	6.1	6.0	7.1	5.2
Italy	5.3	5.6	5.5	6.4	5.1
Cuba	4.6	4.8	4.8	5.1	4.4
United Kingdom	4.3	4.6	4.6	5.2	4.1
Switzerland	4.1	4.4	4.4	5.3	3.8
South Korea	3.8	3.7	3.6	2.9	3.2
Mexico	3.2	3.2	3.0	3.4	3.1
Spain	3.2	3.1	3.1	2.8	3.2
Austria	2.7	3.0	3.0	3.8	2.5
Iran	3.0	2.9	2.8	2.5	3.1
Argentina	2.3	2.3	2.2	2.3	2.3
Other	36.9	36.5	37.5	35.3	37.7

[1] Includes both active and inactive physicians.

Source: 1967: Theodore, C. N.; Sutter, G. E.; and Haug, J. N. *Medical School Alumni, 1967.* Chicago, American Medical Association, 1968.

1969, 1971, 1972: American Medical Association. *Profile of Medical Practice,* 1971, 1972, and 1973 editions. Chicago, The Association.

1970: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.

majority (88 percent) of the FMG's from developing countries (predominantly from Asia) had graduated after 1955.[12]

FMG's tend to be younger than their U.S. counterparts. In 1970, slightly more than one-third of the United States graduates and slightly less than one-third of the Canadian graduates were under 40 years of age. Among FMG's, in contrast, almost one-half were under 40. Over 75 percent of the FMG's, furthermore, were under 50 years of age, compared with 61 percent of the U.S. graduates, and only 55 percent of Canadian graduates. (See Table 17.) FMG's are also more often women. Females numbered 6 and 7 percent of U.S. and Canadian graduates respectively, but more than twice that proportion of the FMG's.

Because many FMG's enter the physician pool as "trainees," relatively small numbers were in office-based practice in 1970. Over one-third of the active FMG's were office-based, as compared with about two-thirds of active Canadian and U.S. trained physicians. Almost another third of all active FMG's were interns or residents, about two and a half times the proportion of U.S. and Canadian graduates. Adding to the FMG interns and residents those who were full-time physicians on hospital staffs, one-half of all FMG's were hospital-based, as contrasted with over one-fifth of U.S. and Canadian physicians. Since FMG's tend to be younger than their U.S. and Canadian counterparts, it is to be expected that more of the FMG's would be in training, and thus in hospital-based practice. FMG's were also more likely to be engaged in research than U.S. trained physicians. (See Table 18.)

Within the FMG aggregate, however, there were substantial differences in the activity distribution of those from developed and developing countries. FMG's from the former had an activity distribution more nearly like that of U.S. trained physicians. On the other hand, FMG's from the developing countries tended much more to be hospital-based. Almost two-thirds of all FMG's from the developing countries were interns, residents, or hospital physicians.

[12] Based on data in: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.

Table 17.

NUMBER OF PHYSICIANS (M.D.) IN THE UNITED STATES, BY AGE GROUP AND COUNTRY OF GRADUATION: DECEMBER 31, 1970

Age group	Number[1] by country of graduation			Percent distribution		
	United States	Foreign	Canada	United States	Foreign	Canada
All ages	270,600	57,200	6,200	100.0	100.0	100.0
25-44 years	130,560	36,260	2,750	48.2	63.4	44.6
25-29[2]	32,830	5,370	370	12.1	9.4	6.0
30-34	33,380	11,900	670	12.3	20.8	10.9
35-39	33,320	9,760	871	12.3	17.1	14.1
40-44	31,020	9,220	840	11.5	16.1	13.6
45-64 years	104,070	16,880	2,290	38.5	29.5	37.1
45-49	33,530	6,830	650	12.4	11.9	10.6
50-54	26,440	3,720	590	9.8	6.5	9.5
55-59	24,050	3,110	580	8.9	5.4	9.4
60-64	20,040	3,210	470	7.5	5.6	7.6
65 years and over	36,010	4,090	1,130	13.3	7.1	18.3
65-69	14,410	1,500	430	5.3	2.6	6.9
70-74	6,790	1,290	430	2.5	2.3	6.9
75 and over	14,810	1,300	280	5.5	2.3	4.5

[1] Includes both active and inactive physicians.
[2] Includes all those reported as "under 30 years of age".

Source: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.

Note: Figures may not add to totals and subtotals due to independent rounding.

Geographically, foreign medical graduates were disproportionately located in the New England, Middle Atlantic, and East North Central divisions. (See Table 19.) Well over one-third of all FMG's were located in New York, New Jersey, and Pennsylvania, with New York being the State most heavily populated with foreign trained physicians. (See Table 19.) Although FMG's comprised only 17 percent of all physicians in the United States, over 25 percent of the physicians in New York, Rhode Island, New Jersey, Illinois, and Delaware were FMG's. This means that the physician/population ratios in these five States would be substantially lower without the FMG's. In New York, for example, the ratio of total physicians (including Canadians and FMG's) to population was 245 per 100,000 in 1970; without the inclusion of Canadians and FMG's however, the ratio would have been 152 per 100,000.

With the recent increase in the number of unsuccessful applicants to U.S. medical schools, the role of American citizens trained in foreign medical schools becomes increasingly important. In 1970-71 alone, nearly 13,500 applicants were turned away from American medical schools.[13] Given continued large increases in applicants, along with unabated interest among rejectees in seeking a medical education and the opportunity to study in foreign schools, the number of Americans studying medicine abroad may evidence sharper growth patterns in the coming years.

The Institute of International Education estimated that in 1969-70 there were more than 3,300 Americans in foreign medical schools.[14] Americans are currently believed to be enrolling in schools outside the United States and

[13] American Medical Association, Council on Medical Education. Medical Education in the United States 1970-71. *Journal of the American Medical Association* 218: 1199-1286, November 22, 1971.

[14] Institute of International Education. *Open Doors, 1971.* Report on International Exchange. New York, The Institute, 1971.

Table 18.

NUMBER OF ACTIVE PHYSICIANS (M.D.), BY MAJOR PROFESSIONAL ACTIVITY AND COUNTRY OF GRADUATION: DECEMBER 31, 1970

Major professional activity	Number of active physicians by country of graduation			Percent distribution		
	United States	Foreign	Canada	United States	Foreign	Canada
All activities	251,240	54,420	5,550	100.0	100.0	100.0
Patient care	225,620	48,190	4,720	89.8	88.6	85.0
Office based	167,950	20,980	3,510	66.8	38.6	63.2
Hospital based	57,670	27,210	1,210	23.0	50.0	21.8
Interns, residents	33,970	16,650	610	13.5	30.6	11.0
Full-time staff	23,700	10,560	600	9.4	19.4	10.8
Medical teaching	4,450	1,010	140	1.8	1.9	2.5
Administration	10,670	1,190	300	4.2	2.2	5.4
Research	8,320	3,290	320	3.3	6.0	5.8
Other	2,110	470	60	0.8	0.9	1.1
Not classified	70	280	10	(1)	0.5	0.2

[1] Less than 0.05 percent.

Source: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.

Note: Figures may not add to totals and subtotals due to independent rounding.

Canada at a rate of 500 per year.[15] It is further estimated, however, that less than one-half of these students actually finish the full course requirements and return to the United States with acceptable credentials.[16] These figures are conservative, however, since the licensure statistics in the United States depict a steady inflow of American graduates at magnitudes of 200-400 per year. In total, 5,972 U.S.-born FMG's were identified in the United States in 1970, almost three-fourths having graduated from schools in Italy, Switzerland, the United Kingdom, Spain, or Mexico.[17]

With increased concerns about physician shortages and maldistribution in this country, programs have recently been created for the transfer of U.S. students studying abroad to United States medical schools. In this direction, for example, such pathways as COTRANS[18] and what is generally referred to as the "5th pathway"[19] have been established.

As seen in the following sections, projections have not been developed separately for U.S.-born M.D.'s trained abroad. This reflects the fact that, despite the distinct possibilities of significant increase in their numbers, these

[15] Mason, Henry R. Foreign Medical Schools as a Resource for Americans. *Journal of the National Association of College Administrative Counselors* 5:16-20, November 1970.

[16] Mason, Henry R. A Profile of 314 Americans Graduating from Foreign Medical Schools. *Journal of the American Medical Association* 209: 1196-1199, August 25, 1969.

[17] Haug and Martin, *op. cit.*

[18] In 1970, the Association of American Medical Colleges (AAMC) established a "coordinated transfer application system," or COTRANS, to assist in the evaluation of U.S. citizens seeking transfer from foreign medical schools to medical schools in this country, basically through participation in Part I of the National Board of Medical Examiners. Transfer applicants apply directly to U.S. medical schools, and acceptance decisions are made by the admissions committee of each school.

[19] The AMA has liberalized requirements for entrance into graduate medical education for U.S.-born graduates of foreign medical schools. As of July 1971, U.S.-born FMG's are being allowed to substitute a year of supervised clinical training under the direction of a U.S. medical school approved by the Liaison Committee on Medical Education for the internship or social service required by a foreign school of medicine. As of 1972, 14 U.S. medical schools were participating in this program, which is known as "the fifth pathway."

Table 19.

NUMBER OF PHYSICIANS (M.D.), BY LOCATION AND COUNTRY OF GRADUATION: DECEMBER 31, 1970

Region, division, and State	Number[1] by country of graduation			Percent by country of graduation			Percent distribution		
	United States	Foreign	Canada	United States	Foreign	Canada	United States	Foreign	Canada
All locations	270,600	57,200	6,200	81.0	17.1	1.9	100.0	100.0	100.0
United States	264,240	54,620	5,980	81.3	16.8	1.8	97.6	95.5	96.5
NORTHEAST	69,580	26,030	2,260	71.1	26.6	2.3	25.7	45.5	36.9
New England	18,440	4,150	840	78.7	17.7	3.6	6.8	7.3	13.9
Connecticut	4,620	1,270	190	76.0	20.9	3.1	1.7	2.2	3.1
Maine	900	170	110	76.1	14.7	9.2	0.3	0.3	1.8
Massachusetts	10,230	2,000	350	81.3	15.9	2.8	3.8	3.5	5.7
New Hampshire	860	150	100	78.1	13.2	8.7	0.3	0.3	1.6
Rhode Island	1,080	500	60	66.2	30.2	3.6	0.4	0.9	1.0
Vermont	760	70	40	87.1	6.2	4.7	0.3	0.1	0.7
Middle Atlantic	51,140	21,880	1,420	68.7	29.4	1.9	18.9	38.2	23.0
New Jersey	7,570	3,220	130	59.3	29.5	1.2	2.8	5.6	2.2
New York	27,800	15,950	1,060	62.0	35.6	2.4	10.3	27.9	17.2
Pennsylvania	15,780	2,710	220	84.3	14.5	1.2	5.8	4.7	3.6
SOUTH	76,440	10,010	770	87.6	1.5	0.9	28.2	17.6	12.6
South Atlantic	40,850	7,220	550	84.0	14.9	1.1	15.1	12.7	8.9
Delaware	540	220	20	69.3	27.7	2.9	0.2	0.4	0.4
District of Columbia	3,250	780	40	79.9	19.1	1.0	1.2	1.4	0.7
Florida	9,510	1,770	170	83.1	15.4	1.5	3.5	3.1	2.7
Georgia	5,090	430	20	91.7	7.8	0.4	1.9	0.8	0.4
Maryland	7,140	2,250	130	75.0	23.6	1.4	2.6	3.9	2.1
North Carolina	5,700	310	60	93.9	5.1	1.0	2.1	0.5	1.0
South Carolina	2,560	100	10	95.9	3.7	0.4	1.0	0.2	0.2
Virginia	5,590	900	70	85.4	13.7	1.0	2.1	1.6	1.1
West Virginia	1,470	460	20	75.3	23.8	0.9	0.5	0.8	0.3
East South Central	13,110	870	60	93.4	6.2	0.4	4.8	1.5	1.1
Alabama	3,220	150	10	95.3	4.4	0.3	1.2	0.3	0.2
Kentucky	3,190	350	20	89.7	9.7	0.6	1.2	0.6	0.4
Mississippi	2,000	70	10	96.3	3.2	0.4	0.7	0.1	0.2
Tennessee	4,700	310	20	93.5	6.1	0.4	1.7	0.5	0.3
West South Central	22,480	1,930	160	91.5	7.9	0.7	8.3	3.4	2.6
Arkansas	1,920	30	10	98.4	1.3	0.3	0.7	(2)	0.1
Louisiana	4,480	260	30	93.9	5.5	0.7	1.7	0.5	0.5
Oklahoma	2,780	110	20	95.7	3.6	0.7	1.0	0.2	0.3
Texas	13,310	1,540	110	89.0	10.3	0.7	4.9	2.7	1.7
NORTH CENTRAL	59,750	14,030	1,280	79.6	18.7	1.7	22.3	24.5	21.0
East North Central	41,010	11,550	930	76.7	21.6	1.7	15.2	20.2	15.1
Illinois	11,610	4,540	170	71.1	27.8	1.1	4.3	7.9	2.8
Indiana	4,950	470	40	90.6	8.6	0.8	1.8	0.8	0.7
Michigan	8,560	2,380	430	75.3	20.9	3.8	3.2	4.2	7.0
Ohio	11,000	3,520	230	74.6	23.9	1.5	4.1	6.2	3.7
Wisconsin	4,890	640	50	87.6	11.5	0.9	1.8	1.1	0.9

See footnotes at end of table.

Table 19

NUMBER OF PHYSICIANS (M.D.), BY LOCATION AND COUNTRY OF GRADUATION: DECEMBER 31, 1970—Continued

Region, division, and State	Number[1] by country of graduation			Percent by country of graduation			Percent distribution		
	United States	Foreign	Canada	United States	Foreign	Canada	United States	Foreign	Canada
NORTH CENTRAL—Continued									
West North Central	18,740	2,480	360	86.9	11.5	1.7	7.1	4.3	5.9
Iowa	2,710	320	30	88.5	10.6	1.0	1.0	0.6	0.5
Kansas	2,580	300	30	88.7	10.3	1.0	1.0	0.5	0.5
Minnesota	5,300	650	200	86.3	10.5	3.2	2.0	1.1	3.2
Missouri	5,280	980	50	83.7	15.6	0.8	2.0	1.7	0.8
Nebraska	1,780	70	10	95.8	3.8	0.4	0.7	0.1	0.1
North Dakota	530	90	40	80.0	13.8	6.2	0.2	0.2	0.7
South Dakota	560	70	0	88.4	11.1	0.5	0.2	0.1	0.1
WEST	58,480	4,550	1,670	90.4	7.0	2.6	21.8	8.1	27.0
Mountain	11,780	780	190	92.4	6.1	1.5	4.5	1.4	3.1
Arizona	2,610	280	50	88.8	9.6	1.6	1.0	0.5	0.8
Colorado	4,080	260	50	92.9	5.9	1.2	1.5	0.5	0.8
Idaho	700	10	10	97.1	1.5	1.4	0.3	(2)	0.2
Montana	740	30	10	94.4	3.8	1.8	0.3	0.1	0.2
Nevada	560	10	20	93.6	2.4	4.0	0.2	(2)	0.4
New Mexico	1,240	130	20	89.4	9.1	1.5	0.5	0.2	0.3
Utah	1,510	40	20	96.1	2.7	1.1	0.6	0.1	0.3
Wyoming	350	10	10	95.1	3.6	1.4	0.1	(2)	0.1
Pacific	46,700	3,770	1,470	90.0	7.3	2.8	17.3	6.7	23.9
Alaska	300	20	0	93.5	5.2	1.2	0.1	(2)	0.1
California	37,480	2,980	1,180	90.0	7.2	2.8	13.9	5.2	19.2
Hawaii	1,000	200	30	80.9	16.4	2.7	0.4	0.4	0.5
Oregon	2,980	140	60	93.7	4.4	1.9	1.1	0.3	1.0
Washington	4,940	430	190	88.8	7.7	3.5	1.8	0.8	3.1
Possessions	1,410	1,410	10	49.8	49.9	0.4	0.5	2.5	0.2
Other[3]	4,980	1,180	190	78.4	18.6	3.0	1.8	2.1	3.1

[1] Includes both active and inactive physicians.
[2] Includes physicians with APO-FPO addresses and with address unknown.
[3] Less than 0.05 percent.

Source: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.

Note: Figures may not add to totals and subtotals due to independent rounding.

graduates will undoubtedly remain a small segment of the overall population of physicians trained abroad who enter the United States physician pool.

PROJECTIONS OF THE SUPPLY OF PHYSICIANS TO 1990

Projections of the supply of active physicians to 1990 presented in this section have been developed on the basis of different assumptions as to the future input of newly trained U.S. physicians and the foreign medical graduate population. Three different projections are provided for each group.

Projection methodologies and findings are shown separately for (1) U.S.-trained M.D.'s and D.O.'s; (2) foreign trained physicians (including graduates from Canadian medical schools); and (3) all active physicians. This approach has been adopted for several reasons. First, although foreign trained physicians play a key role in the total profile of the physician supply, there is substantial interest in what the physician supply would be if only U.S. graduates were considered. Second, BHRD, which has a

major Federal responsibility for support of U.S. medical and osteopathic schools, and DHEW, which has as its goal the maintenance and improvement of the Nation's health care, are both vitally concerned with the future supply of all types of physicians. Third, and perhaps most important a considerable disparity exists between the quantity and quality of the information on U.S. trained physicians and that on foreign medical graduates. Information available on foreign trained physicians is often quite sketchy and, in general, of limited value for purposes of projections. For these reasons, it was considered essential that separate projections be developed for the two groups.

PROJECTIONS OF THE SUPPLY OF UNITED STATES TRAINED PHYSICIANS

Projections of the supply of U.S. trained physicians for the 1970-90 period were based on: (1) the number of active U.S. trained physicians practicing as of December 31, 1970 and separations from that pool over the 1971-90 period; and (2) new graduates from U.S. medical and osteopathic schools and separations from the pool of new graduates.

Data on active M.D.'s in 1970 were obtained from the annual publication of the American Medical Association.[20] The American Osteopathic Association provided the estimate of active D.O.'s for the same date. Data on graduates of U.S. medical and osteopathic schools in 1971 were obtained from school reports on FY 1972 capitation grant applications filed by the schools with BHRD.[21]

Estimates of graduates for the first projected year, 1972-73, were those prepared by schools on the BHRD capitation grant applications. Information on actual and projected first-year enrollments in these schools (through academic year 1974-75) was also provided on the applications and largely formed the basis for the graduate projections.

Methodology and Assumptions. In developing the enrollment data needed to estimate graduates over the projection period, it was recognized that capitation grant data by themselves did not adequately reflect the number of first-year students that would be enrolled in schools beginning operation in academic years 1973-74 and 1974-75. A considerable number of States, localities, universities, or citizen groups have expressed an intent to establish new medical schools in the future; many, furthermore, have completed feasibility studies, drawn up extensive plans, and obtained backing by State legislatures.

In order to ascertain which of the potential new schools were close to actuality and appeared most likely to open during the 1973-75 period, a budgetary projection of startup grants (prepared by the Division of Physician and Health Professions Education, BHRD) was examined, along with publications of the Association of American Medical Colleges (AAMC). On the basis of this information, it was concluded that, apart from Southern Illinois University, which was included in the capitation data, only one new medical school seemed firm enough to include in the projections for this period. The average initial class size for medical schools established during the 1952-70 period (33.5) was used to estimate first-year enrollment for the new medical school. A similar procedure was followed for potential osteopathic schools. This resulted in adding three new schools to the projections for 1973-75, one of medicine and two of osteopathy.

The methodology also takes into account enrollments in accelerated programs (those less than 4 years in duration). These were assumed to reflect the same share of total graduates in the years ahead as was reported by the schools for the academic year 1971-72. The assumption that there would be no greater flow of 3-year medical students through existing schools is in line with the overall assumption as to Federal funding.[22] Although the grant applications did provide graduate projections through 1974-75 of 3- and 4-year graduates, these figures were felt to be unrealistic estimates for projection purposes.

Most medical schools in the United States conduct 4-year academic programs which, with the addition of summer and other vacation time, result in a total of 45 months. However, with rethinking concerning the need for programs of 4 years' duration, focus has been placed on the acceleration of M.D. and D.O. training as a method of producing additional physicians.

Accelerated programs have been defined by Blumberg to be "those which require less calendar time to complete than current (or conventional) programs at U.S. medical schools."[23] There are, in general, two basic methods of implementing the acceleration: (1) a reduction in the number of total credit hours of instruction required or a reduction in the specific content of instruction so that only 3 academic years are needed; and (2) compression of the time needed to complete the presently required program.

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[20] Haug, J. N.; Roback, G. A.; and Martin, B. C. *Distribution of Physicians in the United States, 1970.* Chicago, American Medical Association, 1971.

[21] Data for U.S. medical schools include figures for graduates of the medical school in Puerto Rico.

[22] This assumes that the future direction of curriculum shortening will not continue the trends in evidence in recent years. A discussion of curriculum shortening can be found in: American Medical Association, Council on Medical Education. Medical Education in the United States 1970-71. *Journal of the American Medical Association* 218: 1204, November 22, 1971.

[23] Blumberg, Mark S. Accelerated Programs of Medical Education. *Journal of Medical Education* 46: 643-651, August 1971.

The first method would result in dramatic changes in requirements for medical licensure and large-scale changes in the format of undergraduate as well as medical education. The latter method, as generally proposed, involves changing the 45-month program to a 36-month program by reducing nonstudy time. Freshmen would enter medical school in July and graduate in June 3 years later.[24]

During World War II, accelerated programs were adopted in most U.S. medical schools in an attempt to meet the increasing demand for physicians imposed by war. These programs reduced the years to graduation from four to three by utilizing summers and vacation time for classes. In addition, a freshman class was admitted every 9 months, permitting two classes to graduate in 1 calendar year, 3 years after the initiation of the program. However, owing to an immediate post-war return to 4-year programs, along with subsequent reduction in admissions to permit schools to return to a conventional schedule, the war-induced acceleration programs produced only temporary increases in the supply of physicians. Shortly after the war, however, the University of Utah pioneered in the development of an accelerated 3-year program which graduated one class each calendar year.[25] This program was favorably received by the students, although the faculty was less enthusiastic about the extra teaching burdens.

In general, very few accelerated programs were developed until the late 1960's. By November 1972, the American Medical Association reported that a total of only 28 schools had some form of 3-year program.[26] Eight of these schools were "conducting or planning for an educational program in which all, or essentially all, medical students will complete their medical school training in 36 successive calendar months or less." Six other schools reported that at least 10 percent of their students were enrolled in programs of 36 months or less. An additional 14 schools stated that 3-year programs were available, but that few students were enrolled.

Some criticism has recently been raised concerning accelerated programs, such as the increased burden upon the faculty because of the elimination of summer vacations and general objections to the alteration of the medical curriculum. However, the number of schools adopting these 3-year programs is increasing and is projected by the AMA to continue to increase. The Association reported that, as of November 1972, at least 20 additional schools (in addition to the 28 previously mentioned) indicated the possibility of incorporating a 3-year program. A total of 101 degree-granting schools reported that a student could obtain an M.D. degree in 36 months (not counting students with advanced standing), thus creating an accelerated capability for most schools. Furthermore, the Association estimates that one-half (approximately 56 schools) of the U.S. medical schools may be providing a 3-year program by 1973.[27]

Because of these developments, for purposes of this report, it was felt necessary to evaluate what the possible impact on graduate output (and consequently on physician supply) would be if accelerated programs took hold in a major and comprehensive way. To determine the *maximum* impact of such shifts, it was assumed that *all* medical schools would convert to a 36-month program in 1 year. Of course, past trends indicate a gradual changeover, if indeed the direction of the current trends does continue.

In a recent article, Blumberg undertook a hypothetical conversion of medical school programs over a 16-year period, assuming that all schools converted at the earliest opportunity during this period.[28] Applying a similar analysis to this report's basic methodology for M.D. graduate projections, the results show an approximate 16,000 increase in the number of graduates over the projection period. A "windfall" of an extra graduating class occurs in the third year after the year of conversion. (See Table 20.)

In effect, such a conversion to accelerated programs would result in one additional graduating class by 1990. Without conversion, students projected as entering medical schools over academic years 1970-71 to 1986-87 would total 253,053. (See Table 21.) Under the 4-year program, and assuming an attrition rate of 5.3 percent over the

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[24]Methods such as doubling freshmen each year by taking in 2 classes would eventually increase the supply of physicians. However, under the strict definition of "accelerated programs," this method would not apply and will not be considered in this report because of its controversial nature.

[25]Blumberg, Mark S. Accelerated Programs of Medical Education. *Journal of Medical Education* 46: 643-651, August 1971.

[26]American Medical Association, Council on Medical Education. Medical Education in the United States 1971-72. *Journal of the American Medical* Association 222: 961-1048, November 20, 1972.

[27]In a related development, a study of the modification of the curriculum in schools of osteopathy has resulted in the "spiral curriculum," which emphasizes a 3-year program leading to the D.O. degree with an incorporation of the fourth year with the internship. Although the time for adoption of such a program has not been determined, the emphasis and direction implied by this program exists. See: Kabara, Jon J. and Jacobson, Lawrence E. The Spiral Curriculum: For Training Osteopathic Physicians. *The D.O.* 12: 93-101, July 1972.

[28]In addition to the Blumberg article cited above, the following 2 studies examine the impact of shortening the physician curriculum: U.S. General Accounting Office. *Report to the Congress: Program to Increase Graduates from Health Professions Schools and Improve the Quality of Their Education.* Washington, U.S. General Accounting Office, 1972; and Rittenhouse, C. H. and Weiner, S. *A Study of the Semi-Annual Admissions System at the University of Tennessee College of Medicine.* Menlo Park, Cal., Stanford Research Institute, March 1971.

Table 20.

PROJECTED ANNUAL NUMBER OF GRADUATES OF MEDICAL SCHOOLS IN THE UNITED STATES UNDER PROPOSED ACCELERATED PROGRAMS COMPARED WITH NUMBER OF GRADUATES IN CONVENTIONAL PROGRAMS: ACADEMIC YEARS 1970-71 THROUGH 1989-90

Academic year	First-year enrollment[2]	Graduates[1] from:		Difference
		Conventional (4-year program)	Accelerated (3-year program)	
Total	–	239,642	255,776	16,134
1970-71	11,348	–	–	–
1971-72	12,375	–	–	–
1972-73	13,390	–	–	–
1973-74	13,857	10,747	22,466	11,719
1974-75	14,339	11,719	12,680	961
1975-76	14,530	12,680	13,123	443
1976-77	14,724	13,123	13,579	456
1977-78	14,921	13,579	13,760	181
1978-79	15,120	13,760	13,944	184
1979-80	15,321	13,944	14,130	186
1980-81	15,526	14,130	14,319	189
1981-82	15,733	14,319	14,509	190
1982-83	15,943	14,509	14,703	194
1983-84	16,155	14,703	14,899	196
1984-85	16,371	14,899	15,098	199
1985-86	16,589	15,098	15,299	201
1986-87	16,811	15,299	15,503	204
1987-88	17,037	15,503	15,710	207
1988-89	–	15,710	15,920	210
1989-90	–	15,920	16,134	214

[1] The attrition rate for 4-year programs (5.3 percent) has also been applied to the 3-year programs.
[2] These figures are those used in the basic methodology projections. In this table it is assumed that all schools convert to 3-year programs beginning with the 1st-year class of 1971-72.

length of the program, the projected enrollment figures result in a total of 239,642 graduates for the projection years 1973-74 to 1989-90 (Table 20). Although the conversion of all schools to an accelerated program would not change the projected number of first-year enrollees in any year of the 1970-71 to 1986-87 period,[29] the conversion to a 3-year program would allow an entering class in academic year 1987-88 to graduate in 1990, the end point of the projection period for graduates. As shown in table 20, a projected freshman class of 17,037 in 1987-88 (also assuming a 5.3 percent attrition experience) would result in a graduating class of 16,134 in 1989-90, a number equal to the overall gain in the number of graduates over the projection period that occurred due to the conversion.

In sum, given the basic figures and projections used in this report, the maximum impact of a complete adoption of accelerated programs would increase the total number of projected graduates from 239,642 to 255,776. Although this increase is significant, it is important to note again that the assumption implicit in this estimate represents a maximum condition. In more realistic terms, however, if medical schools in the United States continue to explore and adopt conversion programs, a continuation of recent trends suggests a very gradual process.

For each year in the projection period, estimates of graduates were computed from earlier first-year enrollments, utilizing an attrition rate of 5.3 percent, the same as

[29] A 4-year attrition rate (5.3 percent) used for the graduate projections has not been changed for the 3-year program. Little is known about 3-year attrition rates. Furthermore, the AMA has eliminated calculations of attrition rates from its reports because of their inaccuracy due to increased flexibility of the M.D. curriculum.

Table 21.

FIRST-YEAR ENROLLMENTS AND GRADUATES IN MEDICAL SCHOOLS IN THE UNITED STATES UNDER BASIC AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1970-71 AND PROJECTED 1971-72 THROUGH 1989-90

Academic year	First-year enrollment			Graduates		
	Basic methodology	Alternative assumptions		Basic methodology	Alternative assumptions	
		Low	High		Low	High
1970-71	11,348	11,348	11,348	8,979	8,979	8,979
1971-72	12,375	12,375	12,375	9,617	9,617	9,617
1972-73	13,390	13,390	13,390	9,850	9,850	9,850
1973-74	13,857	13,857	13,857	10,747	10,747	10,747
1974-75	14,339	14,339	14,339	11,719	11,719	11,719
1975-76	14,530	14,339	14,722	12,680	12,680	12,680
1976-77	14,724	14,339	15,115	13,123	13,123	13,123
1977-78	4,921	14,339	15,519	13,579	13,579	13,579
1978-79	15,120	14,339	15,933	13,760	13,579	13,942
1979-80	15,321	14,339	16,359	13,944	13,579	14,314
1980-81	15,526	14,339	16,796	14,130	13,579	14,696
1981-82	15,733	14,339	17,245	14,319	13,579	15,089
1982-83	15,943	14,339	17,705	14,509	13,579	15,492
1983-84	16,155	14,339	18,178	14,703	13,579	15,906
1984-85	16,371	14,339	18,664	14,899	13,579	16,331
1985-86	16,589	14,339	19,163	15,098	13,579	16,767
1986-87	16,811	14,339	19,676	15,299	13,579	17,215
1987-88	–	–	–	15,503	13,579	17,675
1988-89	–	–	–	15,710	13,579	18,147
1989-90	–	–	–	15,920	13,579	18,633

Source: 1970-71 first-year enrollment: Medical Education in the United States, 1970-71. *Journal of the American Medical Association* 218: 1199-1316, Nov. 22, 1971.
1971-72 through 1974-75 first-year enrollments: Applications for capitation grants submitted to BHRD.
1970-71 graduates: Applications for capitation grants submitted to BHRD.

that reported for the entering class of students in 1967.[30] An examination of historical data on attrition among medical students revealed a gradual rise from 5.5 percent for entering students around 1950 to about 13 percent for the entering class of 1957. For several years thereafter, attrition ranged narrowly between 12 and 14 percent. Beginning with the 1961 entering class, however, attrition has declined continously, returning in 1967 to the proportion in evidence virtually two decades earlier. The projection methodology for this report assumes that the attrition rate of 5.3 percent will be maintained for the entire projection period.

Although projected estimates of supply will vary as attrition rates differ, slight variations in the attrition patterns of medical students have only a minor impact on the overall supply estimates. Under the basic methodology, for example, if the attrition rate were reduced from 5.3 to 3 percent, only about 6,100 additional graduates would be expected over the entire projection period. Yet, although this effect is relatively minor when compared to total graduates, it nonetheless represents the output of two to three medical schools over this period.

It should be noted that the use of single-point attrition rate estimates is not without limitations. For example, in the derivation of the attrition figure, the number of medical school graduates in a particular year is reported as of June. The attrition estimate is overstated somewhat by not including as graduates those students who graduate later than June. Furthermore, the expansion of combined degree programs, aided in part by Federal funding, affects the derivation of attrition estimates. As part of recent developments in curriculum "tracks," for example, a small but

[30] American Medical Association, Council on Medical Education. Medical Education in the United States 1970-71. *Journal of the American Medical Association* 218: 1199-1286, November 22, 1971.

growing number of first-year students are entering combined M.D.-Ph.D. programs which total 6 years in length. Moreover, some students are choosing to take M.S. or M.P.H. degrees before graduation. Although a number of such programs exist, information on their extent and coverage is rather limited. The AAMC, with the assistance of Federal funds, is currently seeking to obtain such information.

Another recent development has also altered the apparent meaning of published attrition rate estimates. Although attrition occurs in U.S. medical schools, recent encouragement of U.S. citizens studying abroad to transfer to U.S. schools has, in a number of instances, filled gaps created by the attrition of U.S.-trained students. In some schools, for example, this situation has resulted in an increase in the number of sophomores over freshmen for a specific class cohort. Without data on such transfers, the computation of attrition rates for these schools would actually produce negative figures.

In addition to estimating the inflow of graduates over the 20-year period, the projection methodology estimated the losses to the profession through deaths and retirements. To develop these estimates on an age-specific basis, it was first necessary to develop a detailed age composition of U.S.-trained physicians as of December 31, 1970. Although an age distribution for active U.S. M.D.'s was unavailable, a distribution was calculated based on the 1967 age data for all active M.D.'s[31], and the resulting distribution was also utilized for D.O.'s.

As indicated in Chapter 1, adjusted age-specific death and retirement rates were applied to yearly estimates of the physician population to derive estimated losses to the profession. In addition to providing such information, this methodology also permitted an examination of shifts in the age distribution of active physicians over the projection period.

A number of studies of the mortality of physicians suggest strongly that M.D.'s tend to live somewhat longer than the overall male population. Furthermore, there is convincing evidence that physicians remain in practice considerably beyond the average age of retirement of the general population. For example, AMA data suggest that, in 1970, 63 percent of all physicians aged 65 and over were still "active". This compared with a total labor force participation rate of 27 percent for similarly aged males in the general population. For these reasons, it was felt necessary to modify separation rate statistics for all working males to bring them more in line with the apparent physician experience. The following paragraphs briefly state the assumptions and methodology employed for this conversion process. (For a detailed description of further background and a more definitive statement of assumptions, corresponding rationale, and methodology, see Appendix A.)

For purposes of this report, it was assumed that physicians tend to live, on the average, approximately 2.5 years longer than did the average U.S. male worker in 1968 (66.6 years). Given this assumption, age-specific death rates published for the overall male population were modified based on information obtained from published Model Life Tables.[32] A subsequent comparison between (a) the proportion of active physicians to total physicians (by age) and (b) male labor force participation rates (by age) was utilized to convert published retirement rates for the overall male working population to a derived series for physicians.

Evaluation of the use of this methodology was accomplished, in part, by applying the derived separation rates to actual published data on the supply of physicians. The converted (and unadjusted) age-specific separation rates were applied to mid-year 1959 M.D. supply figures (AMA data), which were brought forward to 1970. Compared to 1970 published supply data (adjusted to mid-year), the converted rates resulted in an estimate 1 percent lower, as compared with an estimate 7 percent lower using unadjusted rates.

By far the most critical determinant of the future supply of U.S.-trained physicians, however, is clearly the number of graduates of U.S. medical and osteopathic schools. The following discussion treats this subject in some detail and provides the background and rationale used in projecting the future stream of M.D. and D.O. graduates.

It goes without saying that Federal funds are important determinants of the level of enrollments in U.S. medical and osteopathic schools. Federal support for construction, research, training, student assistance, and other medical school activities comprises a significant portion of their total support. Although public medical schools receive over 50 percent of their income for operating expenditures from appropriations by State legislatures (a proportion that has remained constant over the period fiscal year 1960-61 to fiscal 1970-71[33]) a significantly large percentage of their income also comes from Federal appropriations. Consequently, enrollments in *all* medical schools, public or private, are clearly affected by shifts or changes in Federal Government support.

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[31] Theodore, C. N. and Haug, J. N. *Selected Characteristics of the Physician Population, 1963 and 1967.* Chicago, American Medical Association, 1968.

[32] Coale, A. J. and Demeny, P. *Regional Model Life Tables and Stable Populations.* Princeton, N.J.: Princeton University Press, 1966.

[33] Comparisons of Patterns of Financing for Private and Public Medical Schools. Datagram. *Journal of Medical Education* 47: 579-583, July 1972.

Detailed statistical information has not yet been developed to measure the precise impact of specific Federal programs upon enrollments. Many Acts of Congress and sections of Acts provide for support of medical schools and students, and only now are attempts being made to measure their impact in a systematic way. Nonetheless, the experience of recent years provides clear evidence of the overall importance of Federal programs on the course of medical education. In the academic year 1963-64, at the time when the Health Professions Education Assistance (HPEA) Act was passed, the United States had a total of 87 medical schools. The entering class of these schools numbered 8,722 while graduates numbered 7,336. By the academic year 1971-72, less than a decade later, the number of medical schools had grown to 108, with a total entering class of 12,361 (an increase of 42 percent) and a total graduating class of 9,551 (an increase of 30 percent). Although many factors obviously were at work to produce such an increase, it is quite apparent that sharply increased Federal support played a major role.

In developing the projections of U.S. medical school graduates, three assumptions were made about the impact of assumed future support patterns on medical school enrollments. This was done in order to allow for several possible reactions of the medical education system to the assumed level of Federal and non-Federal support. An examination of trend data on enrollments in U.S. medical schools provided the major insights into the possible course of future enrollments and into possible alternative assumptions. This analysis showed that during the 1952-66 period, prior to any significant impact from Federal legislation, increases in first-year medical school enrollment occurred through both the building of new schools and the expansion of existing schools. Trends in freshman enrollment of schools already established in 1952 were examined for the entire period, as were trends in freshman enrollment among the 11 new schools opened during the 14-year period.

Under the first (or "basic") assumption concerning medical school enrollments, it was assumed that increases in first-year enrollments from the year 1975-76 to the mid-1980's would occur at the same yearly rate as that experienced in the 1952-66 period. Implicit in this methodology is the assumption that, even in the absence of massive Federal stimuli to increase enrollments, the number of first-year students in medical schools would continue to increase, although at a more moderate pace than during the 1966-72 period of substantial Federal funding. This increase would be accomplished both through expansion of enrollments within existing schools and construction of new schools. On this basis, annual enrollment increases of about 1.3 percent for M.D.'s and 0.6 percent for D.O.'s were used. (See Tables 21 & 22.)

Under the *second assumption*—termed the "low" alternative, which is the most conservative of the three—the total number of first-year students enrolled per year in the 1975-76 to 1986-87 period would remain at the 1974-75 level. This means that funds from sources other than the Federal Government, when combined with Federal funds, would be adequate to support the enrollment level of the mid-1970's but not to bring about any further increases in enrollments. There is some evidence, however, that recent developments such as the increased public awareness of physician "shortages" and increased public demand for improved health care would bring forth the necessary non-Federal funds to continue to increase medical school enrollments. Nevertheless, such a "low" projection serves to indicate one possible realistic boundary of student enrollments.

In the *third assumption*—the most liberal of the three—it was assumed that freshman enrollment would increase at a greater rate than in the pre-Federal funding period (as used in the basic methodology) but at a less rapid rate than that observed in the latter 1960's and early 1970's when Federal funds for medical schools and students were increased sharply. For this assumption, an arbitrary annual rate of increase twice as great as the 1952-66 experience was employed; i.e., enrollments were projected to rise at annual rates of about 2.7 percent for M.D.'s and 1.2 percent for D.O.'s.

The growing awareness of health care needs in this Nation could very well result in such a further expansion in enrollments. Potential manpower shortages and/or maldistributions resulting in health care delivery problems have become a political and social issue. As the wealth of this country rises within the next two decades, enabling more people to purchase more extensive health care, the need for support of M.D. and D.O. schools may be increasingly recognized by the public, resulting in further increases in funding and possibly in enrollments.

There are, however, two considerations that provide some rationale for not setting this "high" assumption any higher than it is. First, it seems reasonable to assume that each established school possesses an internal capacity level and that a school's educational efficiency and effectiveness are lessened when that capacity is exceeded; thus, increases in enrollments could not easily continue to rise as they did in the late 1960's and early 1970's without a large number of new schools being set up or existing ones greatly expanded. Second, part of the large increase in the supply of young people entering medical school in the 1960's reflected the post-war "baby boom" and the sharp rise in college-age population in the late 1960's. This phenomenon will not recur during the late 1970's and 1980's. In fact, the reduction in the birth rate observed in the 1960's will

Table 22.

FIRST-YEAR ENROLLMENTS AND GRADUATES IN OSTEOPATHIC SCHOOLS UNDER BASIC AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1970-71 AND PROJECTED 1971-72 THROUGH 1989-90

Academic year	First-year enrollment			Graduates		
	Basic methodology	Alternative assumptions		Basic methodology	Alternative assumptions	
		Low	High		Low	High
1970-71	623	623	623	472	472	472
1971-72	670	670	670	491	491	491
1972-73	767	767	767	546	546	546
1973-74	823	823	823	590	590	590
1974-75	916	916	916	634	634	634
1975-76	922	916	927	726	726	726
1976-77	927	916	939	779	779	779
1977-78	933	916	951	867	867	867
1978-79	939	916	963	873	867	878
1979-80	945	916	975	878	867	889
1980-81	951	916	987	884	867	901
1981-82	957	916	999	889	867	912
1982-83	963	916	1,012	895	867	923
1983-84	969	916	1,024	901	867	935
1984-85	975	916	1,037	906	867	946
1985-86	981	916	1,050	912	867	958
1986-87	987	916	1,063	918	867	970
1987-88	–	–	–	923	867	982
1988-89	–	–	–	929	867	994
1989-90	–	–	–	935	867	1,007

Source: 1970-71 first-year enrollment: American Osteopathic Association, Office of Education. *Educational Supplement January 1971.*
1971-72 through 1974-75 first-year enrollments: Applications for capitation grants submitted to BHRD.
1970-71 graduates: Applications for capitation grants submitted to BHRD.

decrease the number of college-age youths available for medical school in the 1980's.

PROJECTION FINDINGS. The basic methodology projection for U.S. medical school graduates results in a total gross[34] graduate input of 268,088 over the entire 1971-90 period. The number of M.D. graduates is projected to rise from 8,979 in 1970-71 to 15,920 in 1989-90, an increase of 77 percent. (See Table 21.) This compares with an increase of 28 percent (from 6,994 to 8,974) during the previous 10 years (1960-61 to 1970-71). The low alternative projects a total gross M.D. graduate input of 253,242; the high alternative, a total of 284,501. The three alternatives used consequently produce total gross M.D. graduate inputs approximately 15,000 graduates apart. However, it is essential to note that if the Federal spending assumption proves to be in error and the rate of increase is that of the 1966-72 experience—nearly 7 percent a year for freshman enrollment for M.D.'s alone—a total gross graduate input (1971-90) of about 350,000 would result, and the number of M.D. graduates would be around 30,000 by 1990.

It is important to interpret the projected number of enrollees and graduates in terms of a capacity-per-school measure. Such an examination provides an additional test of the reasonableness of the projections. Under the basic methodology, the number of medical schools is projected to increase from 103 in academic year 1970-71 to 114 as of 1974-75, and to 126 by 1986-87. These projections would give an average of 133 first-year students per medical school by 1986-87, compared to an actual average of 110 per school in 1970-71 and a projected 126 per school for 1974-75. The slowdown projected for the 1974-75 to 1986-87 period appears consistent with the assumption about funding support underlying these projections. Similarly, using the basic methodology, the projections result in an average of 126 graduates per medical school as of 1989-90. This ratio appears to compare reasonably with

[34] Before deduction of death and retirement losses.

that of medical schools in 1974-75 producing graduates 4 years later (119 per school). In line with these projections, corresponding estimates derived by the high methodology also appear to reflect realistic expectations under the assumptions advanced—139 medical schools and 142 first-year students per school by 1986-87 and 134 graduates per school by 1989-90.

Two separate, but brief, analyses were undertaken to further ascertain the reasonableness of the basic projections. The first analysis compared the number of 22-year-olds in the overall population to entering medical school freshmen for selected historical, as well as projected years. The rationale for this comparison involved an implicit assumption that enrollees in medical schools should be relatively closely related to population trends for this age cohort. An examination of the data indicated that the ratios of medical school freshmen to 22-year-olds remained relatively constant between 1960 and 1970, though with noticeable dips in 1966 and 1970. (See Table 23.) The relationship in the late 1960's reflects the fact that the number of 22-year-olds was increasing at a faster rate than freshman enrollment. This phenomenon, in part, could be attributed to: (1) the impact of the post World War II "baby boom," which was not in evidence in the late 1950's and early 1960's; and/or (2) the fact that *enrollees* are being compared here to population groups, rather than the number of *applicants*. The ratio of freshman medical students to 22-year-olds is projected to remain relatively constant to 1990 at about the same level as was evident in the early 1960's, when the "baby boom" was not a factor. A slight increase in the ratio, however, is projected to occur in the middle 1980's, largely reflecting a showdown in the rate of population growth for the 22-year-olds.

The second analysis, in contrast, considered the ratio of freshman medical students to bachelor's degrees. The historical data reveal that the ratios declined somewhat between academic years 1960-61 and 1970-71, implying that the number of B.A. degrees have been increasing at a faster yearly rate than entrants into medical schools. This phenomenon has been projected to continue. This means that if B.A. figures were the sole determinant of freshmen in medical schools, the projection figures would appear conservative if anything.

Table 23.

FIRST-YEAR MEDICAL STUDENTS, BACHELOR'S DEGREES, AND 22-YEAR OLDS: SELECTED YEARS ACTUAL 1960-61 THROUGH 1972-73; PROJECTED 1974-75 THROUGH 1980-81

Academic year	First-year medical students[1]	Bachelor's degrees[2]	Number of 22-year olds[3] (in 1,000's)	First-year medical students per 1,000:	
				Bachelor's degrees (1)÷(2)	22-year olds (1)÷(3)
	(1)	(2)	(3)	(4)	(5)
1960-61	8,298	389,183	2,238	21.3	3.7
1962-63	8,642	414,275	2,303	20.9	3.8
1964-65	8,856	494,174	2,642	17.9	3.4
1966-67	8,964	551,040	2,810	16.3	3.2
1968-69	9,863	666,710	2,809	14.8	3.5
1970-71	11,348	827,234	3,528	13.7	3.2
1972-73	13,390	903,000	3,548	14.8	3.8
1974-75	14,339	990,000	3,753	14.5	3.8
1976-77	14,724	1,100,000	3,981	13.4	3.7
1978-79	15,120	1,207,000	4,098	12.5	3.7
1980-81	15,526	1,300,000	4,237	11.9	3.7

[1] Projections are by basic methodology.
[2] Include 1st-professional degrees. Degrees shown are those granted in academic year preceding medical school year.
[3] As of July 1 in year specified as beginning of academic year.

Source: 1960-61 through 1970-71 first-year medical students: Medical Education in the United States, 1970-71. *Journal of the American Medical Association* 218: 1199-1316, Nov. 22, 1971.
Bachelor's degrees: Simon, Kenneth A. and Fullam, Marie G. *Projections of Educational Statistics to 1979-80.* Office of Education Pub. No. 10030-70. U.S. Government Printing Office, 1971.
22-year olds: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, Nos. 311, 314, 441, and 470.

It should be noted that dissimilar projected results in the two analyses occur primarily because the number of B.A. degrees is projected to increase at a faster rate than 22-year-olds. These projections imply an increase in the number of college-educated 22-year-olds, thus confirming the reasonableness of the M.D. freshman enrollment projections.

Adding these projected M.D. graduate inputs, as well as those for D.O.'s, to the existing pool of U.S. physicians (after allowance for separations from both groups) provides an estimate of the total supply of U.S.-trained physicians. Under the basic assumption, the supply of active U.S.-trained physicians is projected to grow from 263,200 in 1970 to 334,800 in 1980, and to 429,800 in 1990, as shown in Table 24. Over the entire 20-year projection period, the number of these physicians is projected to increase by 166,600, or by approximately 60 percent. Although these estimates appear striking at first glance, they are not far out of line with the experience of recent years. Between 1963 and 1970, for example, the number of active U.S.-trained physicians rose at an average yearly rate (compounded) of 1.6 percent; this compares with projected yearly changes (compounded) of 2.4 and 2.5 percent in the 1970-80 and 1980-90 periods, respectively.

During the 1960's, increases in the physician/population ratio for all physicians could be attributed largely to the heavy influx of foreign trained M.D.'s. Counting U.S.-trained physicians alone, the ratio rose only from 125 to 129 per 100,000 population in the 1963-70 period. Under the basic methodology, this ratio is projected to rise to 148 per 100,000 population in 1980 and to 172 per 100,000 population by 1990, as shown in Table 24.

It should be noted that the population projection series utilized to calculate these future ratios is a very conservative one. Using a higher population series would lower these ratios somewhat. For example, the projected ratio for 1990 would be lowered from 172 to 154 per 100,000 population, if a very liberal population projection were used.

Given the supply projections developed with the basic methodology and the conservative population series adopted, the projected population ratio for 1990 shows an interesting phenomenon. In effect, the 1990 ratio projected for U.S.-trained physicians alone (172 per 100,000) is almost the same as the ratio that is projected to prevail in 1975 for all physicians—foreign and U.S.-trained combined (Table 25). Although not intended to negate the efficacy of using population ratios to indicate levels of medical care, this phenomenon does raise some interesting questions

Table 24.

SUPPLY OF ACTIVE PHYSICIANS (U.S. TRAINED M.D. AND D.O.) AND PHYSICIAN/POPULATION RATIOS, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 and 1970; PROJECTED 1975-90

Projection series	1960	1970	1975	1980	1985	1990
	Number of active physicians (U.S. trained M.D.'s and D.O.'s)					
Basic methodology	N.A.	263,200	291,500	334,800	381,100	429,800
Alternatives:						
Low	N.A.	263,200	291,500	334,200	375,800	414,600
High	N.A.	263,200	291,500	335,400	386,700	446,500
	Rate per 100,000 population[1]					
Basic methodology	—	129.2	135.7	147.5	159.2	171.5
Alternatives:						
Low	—	129.2	135.7	147.3	157.0	165.4
High	—	129.2	135.7	147.8	161.6	178.2

[1] Resident population as of July 1 for 50 States and the District of Columbia.

Source: 1970 U.S. trained M.D.'s: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.
1970 D.O.'s: Unpublished data provided by the American Osteopathic Association.
Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, Nos. 468, 477, and 483.

Note: Figures in this table may differ from the sum of M.D.'s and D.O. in Table 25 due to independent rounding.

Table 25.

SUPPLY OF ACTIVE PHYSICIANS (U.S. TRAINED M.D. AND D.O.), USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 AND 1970; PROJECTED 1975-90

Projection series	1960	1970	1975	1980	1985	1990
	Number of active U.S. trained M.D.'s					
Basic methodology	N.A.	251,200	277,900	318,300	361,500	407,100
Alternatives:						
Low	N.A.	251,200	277,900	317,700	356,300	392,300
High	N.A.	251,200	277,900	318,800	367,000	423,400
	Number of active D.O.'s					
Basic methodology	([1])	12,000	13,600	16,500	19,600	[2] 22,700
Alternatives:						
Low	([1])	12,000	13,600	16,500	19,500	22,700
High	([1])	12,000	13,600	16,600	19,800	23,200

[1] There were approximately 12,200 active D.O.'s in 1960. The number declined between 1961 and 1962 because the California College of Medicine (formerly the College of Osteopathic Physicians and Surgeons) granted about 2,400 M.D. degrees to D.O.'s who had received the latter degree from that school. Beginning in 1962 these physicians have been included in the count of M.D.'s.

[2] Using the age distribution of D.O.'s from the preliminary findings of the 1971 American Osteopathic Association Survey of Osteopathic Physicians, the projected number of D.O.'s in 1990 would be about 1,000 less than shown in this table.

Source: 1970 U.S. trained M.D.'s: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.

1970 D.O.'s: Unpublished data provided by the American Osteopathic Association.

about the profile of physician supply. U.S. self-sufficiency in producing M.D.'s has been described by some as a very desirable goal. According to the projections, the "level of medical care" implied by the 1975 ratio for all physicians would be reached by the supply of U.S.-trained physicians by about 1990.

The projections of the supply of U.S. trained physicians largely mirror the findings revealed by the projections of all physicians in active practice. Under the basic methodology, the supply of active U.S.-trained M.D.'s is projected to grow from 251,200 in 1970 to 318,300 in 1980 and to 407,100 in 1990 (Table 25). The average yearly changes (compounded) for this group are virtually identical to those projected for all U.S.-trained physicians.

The supply of active osteopathic physicians, however, is projected to grow at a somewhat faster pace—relative both to the recent experience of D.O.'s as well as to the projected increase among M.D.'s. Between 1963 and 1970, for example, the number of active D.O.'s rose from 10,800 to 12,000—an average yearly increase (compounded) of 1.6 percent, the same as that for U.S.-trained M.D.'s. The supply of active D.O.'s, however, is projected to grow to 16,500 by 1980 and to 22,700 by 1990[35], an average yearly increase (compounded) of 3.2 percent in 1970-80 and 3.2 percent in 1980-90. (See Table 25.) Hence the ratio of active D.O.'s to all U.S.-trained physicians is projected to increase slightly over the next two decades—from 4.6 percent in 1970 to 5.3 percent in 1990. This finding does not seem to be inconsistent with the trends over the past decade towards greater professional acceptance and increased public awareness of the role of osteopathic physicians.

In addition to the basic projection, alternative projections were developed of the future supply of U.S.-trained physicians, for M.D.'s and D.O.'s combined. It should be noted, however, that given the assumptions on enrollment growth stated earlier, the supply estimates projected by the alternatives begin to show significant divergences from the basic supply estimates only during the last 10 years of the

[35] Using the D.O. age distribution available from the preliminary findings of the 1971 AOA survey, the projected number of D.O.'s in 1990 is reduced by about 1,000 from findings reported in Table 25.

projection period. This results from the fact that the same graduate estimates were used for all three projections through academic year 1977-78.

Under the high alternative projection, the supply of U.S.-trained physicians is projected to grow to 446,500 by 1990—a 70-percent increase over the 1970-90 period, compared with an increase of 63 percent in the basic projection. Under the low alternative, in contrast, the supply is projected to reach 414,600 in 1990, a 58-percent growth over the next two decades. For the 1980-90 period, the basic, high, and low assumptions project increases of 28.4, 33.1 and 24.2 percent, respectively. (See Table 24.)

The divergence in the supply estimates projected by the high and low alternatives would be 31,900 physicians by 1990, with the low estimate being about 8 percent below the high figure. This difference approxiates the output of 16 medical schools over a 20-year period.

Compared to the ratio of 172 U.S.-trained physicians per 100,000 population projected for 1990 by the basic methodology, the low alternative projects a ratio of 165 per 100,000, while the high alternative projects a ratio of 178 per 100,000. Over the 1970-90 period, the basic methodology projects the number of U.S.-trained M.D.'s and D.O.'s to increase by 62 and 89 percent, respectively. The high alternative projects increases of 69 and 93 percent, respectively; while the low alternative shows projected growth at 56 and 86 percent.

PROJECTIONS OF THE SUPPLY OF FOREIGN MEDICAL GRADUATES

This section provides projections to 1990 of the supply of foreign medical graduates (FMG's), also under three different assumptions. For an adequate understanding of the projections presented here, it is important for the reader to keep in mind the gaps and weaknesses in the data on foreign medical graduates.

The primary source of data on FMG's is the master file of the American Medical Association and the numerous AMA publications based on that file. The AMA defines an FMG as "anyone graduating from a medical school outside the United States, its possessions, and Canada." Theoretically AMA records provide data on the number and characteristics of all FMG's in the United States, at a point in time, as well as on trends in FMG's over time. However, in practice, difficulties in locating and recording FMG's as they enter or leave the country or find employment here have created numerous problems in terms of both current and historical data. Although the following section briefly describes some of these problems, it is by no means meant to cover the full scope of the FMG data difficulties.

In order to be included in the AMA records, as of 1961, an FMG had to (1) have passed the examination given by the Educational Council for Foreign Medical Graduates (ECFMG) and received a standard ECFMG certificate and/or (2) have received a full license from his State of residence to practice.[36] Most FMG's in the United States are believed to have passed the examination and thus appear in the AMA files, but an unknown number are thought to be missing from AMA records for one reason or another.

The ECFMG examination can be taken by a medical graduate prior to or upon entry into the United States. After passing the examination, the FMG is eligible for a number of approved training and other activities, but he cannot provide direct patient care unless he is fully licensed. An unknown number of FMG's never take or pass the ECFMG examination or that of a State licensing board after entry into this country. Those who do not return to their country of origin may find employment here as technicians, in limited-practice situations, or in nonmedical activities. Furthermore, an FMG who wishes to be employed in certain activities, such as in a State mental hospital, may receive a temporary license to practice even though he has not passed the ECFMG examination, and such FMG's are not easily located or counted. Similarly, those in nonapproved training programs may not be included in the AMA files. Moreover, an FMG who is engaged in administration, research, or teaching is not obligated to have a license or to have passed the ECFMG examination.

In addition to problems of possible underreporting of the FMG population, no precise information exists as to their patterns of immigration or emigration. FMG's entering the country are recorded by the Immigration and Naturalization Service (INS) and may be on the records of the ECFMG or the AMA[37], but no accurate records are available on individual FMG's who temporarily or permanently leave the country. A recent study by Haug and Stevens[38], which utilizes unpublished AMA data, indicates that approximately 80 percent of the FMG's who were in the United States in 1963 were also in this country in 1971. In addition, the study reports that approximately 70

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[36]Since 1961, two ways of entering the United States have been created for U.S.-born FMG's. COTRANS and the "fifth pathway," which are described in footnotes 18 and 19 above, have facilitated the reentry of Americans studying medicine abroad into U.S. medical schools and AMA-approved internships and residencies, respectively.

[37]The immigration figures are for self-designated "physicians," with no check upon the accuracy of this designation. More significantly, however, the INS counts provide no information on whether the entrants are actually practicing as physicians upon entry into the United States.

[38]Haug, James and Stevens, Rosemary. *The Physician "Brain Drain"; A Follow-up Study of Foreign Medical Graduates Located in the United States in 1963 and in 1971.* (Unpublished)

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percent of those FMG's who were in the United States in 1963 for "temporary" training (interns and residents) were located in the AMA files in 1971. It should be noted, however, as stated by the authors, that these findings may be somewhat biased owing to limitations in the AMA data and the fact that no information exists as to the number of FMG's who were here in 1963 and 1971 but emigrated and then returned sometime within that period. In addition, the data are not necessarily representative of the situation for FMG's who are newly entering the United States. Since many of those in the United States in 1963 may already have been here for a number of years, their 1963-71 experience is not necessarily the same as those who entered the country during that period.

With the sparsity of data on emigration and incomplete immigration, training, and employment information, it is also difficult to develop or assess trend data on the total number and composition of FMG's, especially on the discrete components of the FMG work force; i.e., those who enter, leave, or remain in this country. Although changes in total FMG's over time can be observed from AMA figures, little can be said concerning movements and tendencies of, say, older FMG's, new entrants, or emigrants. Although the AMA has published some limited data on the FMG work force at various points in time, these total numbers represent a net concept, with little information available on the specific FMG's entering or leaving that total in the year. For example, although the total number of FMG's in the United States reported by the AMA increased by about 5,000 in 1971, this would appear to really reflect many more than 5,000 FMG's actually entering the United States in that year.

The reader should keep in mind these conceptual and statistical considerations when assessing the projections presented here. For purposes of the remainder of this report, it should also be noted that Canadian graduates are included within the FMG component unless specified to the contrary.

METHODOLOGY AND ASSUMPTIONS. Since the most critical aspect of the projection methodology is obviously that relating to the future increase in FMG's, three different assumptions were made as to the size of the annual FMG increment; i.e., the net increase in the number of FMG's who will be added to the physician manpower supply each year over the next two decades.

According to the limited available data from AMA files, an average net change of approximately 3,800 FMG's per year occurred from 1963 through 1970. In 1971, the net increment rose to 5,200. This sharp 1-year increase in the AMA count of FMG's, along with the sharp increases in immigration reported by INS in both 1971 and 1972, has posed important questions about the future supply of FMG's. Without adequate emigration data, unfortunately, relatively little can be said about the pool of FMG's in the United States at different points in time. Although the net changes in the FMG population were analyzed to determine overall FMG manpower growth, little was gleaned about the characteristics, age, location, etc., of those who entered or left the pool in these years.

Several views concerning the future growth in the FMG supply have been expressed by manpower experts, but no consensus appears to have emerged. This lack of agreement reflects a combination of several factors, among them, questions as to the reliability of current and historical information on FMG's; differing viewpoints as to the implications for the future of the 1970-72 experience; different views as to what has drawn FMG's to the United States; and the impact of changes in immigration or licensing laws. It is believed by some that the recent sharp increases reflect little more than a diminution of the backlog of FMG's in this country resulting from the recent changes in U.S. immigration laws. In 1965, an amendment terminated the national quota system and assigned priorities to technicians and professionals with skills considered in short supply in this country. At that particular time, a physician shortage was declared. In addition, a 1970 change in the immigration laws eliminated the 2-year mandatory emigration of FMG's on exchange visas before permitting their reentry. At present, unless an FMG ". . .is sponsored by the U.S. Government or his own government (and the vast majority are not sponsored), or unless the Department of State determines that his services are needed at home, an FMG can now have his visitor visa converted to permanent resident status."[39]

A careful consideration and analysis of the immigration and exchange-visitor data must be made in order to evaluate their implications for future FMG supply. Although the number of immigrants rose substantially in 1971 and 1972, the number of exchange visitors declined, reaching its lowest level in 7 years. Furthermore, data from INS indicate that a substantial number of the immigrants reported in the past few years are in reality exchange visitors already in the United States who have shifted to immigrant status. Even so, taken together, the increase in exchange visitors and immigrants combined is much less sharp than among immigrants alone; the 1972 increase was only about 500, the smallest annual increase in 3 years (after the sharp rise in 1970). (See Table 26.) In addition, the observed yearly increments in the FMG supply reported

[39] Dublin, T. D. The Migration of Physicians to the United States. *The New England Journal of Medicine* 286: 870-877, April 20, 1972.

Table 26.

PHYSICIANS ADMITTED TO THE UNITED STATES, BY IMMIGRATION CLASSIFICATION: FISCAL YEARS 1968-72

Immigration classification	Total 1968-72	1968	1969	1970	1971	1972
Total physicians admitted	47,537	9,125	7,515	8,523	10,947	11,427
Immigrant physicians:						
Total admitted	21,942	3,128	2,756	3,158	5,756	7,144
Occupational preference:						
Total	6,027	1,036	996	840	1,484	1,671
Third preference, admissions	3,101	692	761	544	564	540
Third preference, adjustments	1,870	181	126	166	557	840
Sixth preference, admissions	415	128	69	84	90	44
Sixth preference, adjustments	641	35	40	46	273	247
All other immigrants admitted	15,915	2,092	1,760	2,318	4,272	5,473
Nonimmigrant physicians:						
Total admitted	25,595	5,997	4,759	5,365	5,191	4,283
Distinguished merit and ability	615	61	62	83	178	231
Other temporary	199	7	20	100	47	25
Trainees	874	228	217	174	173	82
Exchange visitors	23,888	5,701	4,460	5,008	4,784	3,935
Transferees	19	0	0	0	9	10

Source: Annual Reports of Immigration and Naturalization Service, tables 8A and 16B.

by AMA during the past 10 years may overstate the increase and might have been partially due to improvements in data collection rather than "true" increases in the FMG population.

Each of the three alternative projections of FMG's presented here views the recent experiences in a somewhat different light, resulting in basic, low, and high projections. The figures include American citizens trained abroad; no separate analysis of this group is made. It must be emphasized that in all the projections, the yearly change in the FMG supply represents *net*, not *gross*, inputs to the physician supply. They do not represent entrants alone (as do the immigrant and exchange visitor figures) but rather represent the net difference between any 2 years in the total active supply of FMG's. As such, they have already allowed for deaths and retirements among existing and new FMG's, as well as emigration of these two groups.

Under the first assumption (termed the basic projection), it was assumed that the 1971 increase in FMG's (as reported by the AMA) did not entirely represent a 1-year phenomenon but was rather a step increase in the FMG increment that would continue into the years ahead. The accelerating increase in new foreign-trained medical licentiates during the past 3 years, together with the increase in the number of FMG's taking the ECFMG examination, helps to support the assumption that the 1970-71 experience initiated a new FMG incremental supply trend. Under this basic assumption, it was assumed that the active 1970 base of FMG's would experience a net yearly increase of 5,200 through 1990 (including Canadians).[40]

The second set of projections (the high estimate) assumed that the 1970-71 experience marked the beginning of a new trend in FMG supply. With the relaxing of immigration laws, the specific evidence of FMG's migrating to the United States because of (1) a lack of job opportunities in their home countries, (2) the higher American standard of living, and (3) the potential relaxing of licensure requirements in rural States, an even further step increase in FMG supply could possibly be expected. As a high alternative, therefore, it was assumed that the active FMG base (including Canadians) of 59,966 in 1970 would increase by 5,200 in 1971 (as it actually did) but would then rise subsequently by an arbitrarily chosen increment of 6,600 a year through 1990.

[40]The 1971-72 experience with FMG estimates supports this assumption. Taking into account the adjustments made in this report for AMA "active" totals, the number of FMG's increased from 59,525 in 1971 to 64,788 in 1972, an increase of 5,267. Canadians are excluded from these figures.

Under the low projection, it was assumed that the foreign trained physician supply in the United States would increase by the same average yearly net increment observed in the 1963-1970 period, as shown by the limited historical data. The active FMG's (including Canadians) in 1970 (59,966) would therefore increase by the already achieved 5,200 increment of 1971 but thereafter would increase by only 3,800 a year through 1990. Part of the rationale for this alternative is the consideration of the proposed abolition of the free-standing internship and the tightening of requirements for approval of residency training programs. This reduction in training programs, along with the increase in U.S. medical school graduates, might very well hamper the future entry of FMG's into U.S. training programs.

PROJECTION FINDINGS. The basic projection of the supply of foreign medical graduates (including graduates of Canadian medical schools) results in a total net graduate input of 104,000 FMG's over the 1971-90 period. The total number of practicing FMG's is projected to rise from about 60,000 in 1970 to 164,000 by 1990, an increase of 173 percent or about 8 percent a year (compounded). This is not substantially different from the 9-percent increase from 1963 to 1971, when the number of FMG's grew from 36,965[41] to 59,966. The low alternative projects a total net graduate input of 77,400; the high alternative, a total (net) of 130,600. The high and low projections thus result in a 53,200 spread in a net foreign-trained graduate input over the 20-year period. (See Table 27.)

The influx of foreign-trained M.D.'s has been largely responsible for the increase in the overall physician/population ratio during the 1960's. Under the basic methodology, foreign-trained M.D.'s would play an increasingly important role in the delivery of health care, despite continued increases in U.S. graduates. The ratio of FMG's to population is projected to increase from 29 to 49 per 100,000 population during the 1970-80 period, and to 65 per 100,000 population by 1990, more than twice the 1970 ratio (Table 27). In addition, FMG's would increase from one-fifth of the total active physician population in 1970 to somewhere around one-third of all physicians in 1990.

Even under the low alternative, significant growth in the FMG population is projected. Their numbers would increase from about 60,000 in 1970 to 99,000 in 1980 and to 137,000 in 1990. Under the high alternative, FMG's would more than triple in numbers between 1970 and 1990, reaching 191,000 by the latter year.

[41] Includes inactive foreign trained physicians.

The alternative projections, as presented, do not estimate the future supply of foreign-trained physicians if the sharp upward trends of the past year or two were simply to be extrapolated to 1990. Such calculations were undertaken, but the subsequent findings were rejected as being highly unlikely. However, they are reported here for information purposes only. For example, if the average annual percent increase in FMG supply (excluding Canadians) over the 1967-71 period were simply extrapolated on a straight-line basis (approximately 8 percent a year increase), the supply of active FMG's would number about 250,000 by 1990—a magnitude roughly equaling the 1970 active supply of U.S.-trained M.D.'s. Unlike the three alternatives shown above (in which net yearly increases were assumed to remain the same over the projection period), if the net changes were assumed to rise incrementally in line with the 1969-71 experience, the supply of active FMG's would be projected to be about 400,000 by 1990. This calculation assumes that the net annual change over the projection period would increase each year by 1,300, the difference between the net annual change of 1969-70 (3,665) and of 1970-71 (4,997). By 1989-90, for example, such an approach would result (unreasonably) in a net increase in that year of around 30,000.

There is strong justification for rejection of an accelerated rate of increase of FMG's.

1. The fact that the number of immigrants and exchange visitors combined who entered the United States did rise in 1971 does not necessarily reflect the beginning of a sharp upward trend. For example, a more rapid increase actually occurred between 1966 and 1968, followed by a sharply reduced number of entrants in 1969; in 1970 the number of total entrants barely equaled the inflow experienced 3 years earlier. A somewhat similar situation occurred in the 3 years following a spurt in 1963. Although these figures have, on balance, been increasing, the rise has been by no means a steady and persistent one. If one were to extrapolate the recent experience of exchange visitors, their incoming numbers would be reduced to negligible amounts over the projection period.

2. It appears unlikely that foreign countries could long permit or afford to have their physicians leaving their countries in the numbers implied by the immigration figures. For example, the immigrant statistics show about 965 Korean physicians entering the United States in FY 1972; this represents about 10 percent of their entire physician population. Obviously, such increases could not continue for very long.

It is evident from the above, however, that regardless of the alternative chosen, FMG's will play an increasingly important role in the U.S. medical care system. To assess the desirability of this development is beyond the scope of

Table 27

SUPPLY OF ACTIVE FOREIGN TRAINED PHYSICIANS, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1970; PROJECTED 1975-90

Projection series	1970	1975	1980	1985	1990
	Number of active foreign trained physicians[1]				
Basic methodology	60,000	86,000	112,000	138,000	164,000
Alternatives:					
Low	60,000	80,000	99,000	118,000	137,000
High	60,000	92,000	125,000	158,000	191,000
	Rate per 100,000 population[2]				
Basic methodology	29.4	40.0	49.3	57.7	65.4
Alternatives:					
Low	29.4	37.4	43.8	49.5	54.8
High	29.4	42.6	54.9	65.8	76.0

[1] Includes Canadian trained physicians.
[2] Resident population as of July 1 for 50 States and the District of Columbia.

Source: 1970 foreign trained physicians: Haug, J. N. and Martin, R C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.
Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, Nos. 468, 477, and 483.

this report, although other reports of Project SOAR will deal with this topic.

PROJECTIONS OF THE TOTAL SUPPLY OF PHYSICIANS

The previous two sections have presented a number of alternate projections to 1990 of U.S. and foreign trained physicians. As indicated earlier, these projections were developed independently in order to show what the future physician supply would be considering only U.S. graduates, as well as to minimize the deficiencies of the data on foreign trained physicians. This section combines the two components and discusses the projected supply profile for all active physicians in the United States.

Between 1960 and 1970, the number of all active physicians rose from 251,900 to 323,200, an increase of 28 percent. (See Table 28.) Over this same period, the number of active physicians per 100,000 population rose from 140 to 159. These increases in large part reflect the growing input of FMG's to the overall physician supply.

Under the basic methodology used to project both components of the total supply, the number of all active physicians is expected to increase to 446,800 in 1980 and 593,800 in 1990. The supply is thus projected to grow by 123,600 (or 38 percent) over the 1970-80 period, and by 147,000 (or 33 percent) over the 1980-90 period. The growth in the physician supply over the next two decades would not only be numerically large, but would also be at a faster annual rate than during the past 10 years.

The basic projection also indicates that the overall physician/population ratio will increase to 197 per 100,000 population in 1980, and to 237 per 100,000 population in 1990. This compares with a ratio of 159 physicians per 100,000 population in 1970. For active U.S.-trained physicians alone, the 1990 ratio would be 172 per 100,000 (Table 24), much the same as the 1975 ratio for all physicians.

The country of training of the overall physician supply is projected to change significantly over the 20-year period. In 1970, for example, physicians trained in Canada and abroad accounted for nearly one-fifth of the total supply of active physicians practicing in the U.S. Under the basic methodology used for both components of the supply profile, this proportion is projected to increase to 25 percent by 1980 and to 28 percent by 1990. Thus the ratio of foreign-trained to all active physicians is projected to rise by virtually 50 percent over the 1970-90 period. Although this represents a striking increase, it should be recalled that the ratio of foreign trained to total physicians in 1970 was double the level registered 10 years earlier.

The projections reveal further developments of interest. Under the basic methodology, the supply of all active

Table 28

SUPPLY OF ACTIVE PHYSICIANS (M.D. AND D.O.) AND PHYSICIAN/POPULATION RATIOS, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 AND 1970; PROJECTED 1975-90

Projection series	1960	1970	1975	1980	1985	1990
	Number of active physicians (M.D. and D.O.)					
Basic methodology	251,900	323,200	377,500	446,800	519,100	593,800
Alternatives:						
Low	251,900	323,200	371,900	433,600	494,100	552,000
High	251,900	323,200	383,100	459,900	544,300	637,100
	Rate per 100,000 population[1]					
Basic methodology	140.0	158.6	175.7	196.9	216.9	236.9
Alternatives:						
Low	140.0	158.6	173.1	191.1	206.5	220.2
High	140.0	158.6	178.3	202.7	227.4	254.2

[1] Resident population as of July 1 for 50 States and the District of Columbia. Rate for 1970 differs from that shown in table 10 because of exclusion of Puerto Rico and outlying areas from population base in this table.

Source: 1960 active physicians: Pennell, Maryland Y. Statistics on Physicians, 1950-63. *Public Health Reports* 79: 905-910, October 1964.
1970 active physicians (M.D.): Haug, J. N.; Roback, G. A.; and Martin, B. C. *Distribution of Physicians in the United States, 1970.* Chicago, American Medical Association, 1971.
1970 active physicians (D.O.): Unpublished data provided by the American Osteopathic Association.
Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, Nos. 468, 477, and 483.

physicians is projected to grow to 400,000 by 1977. The supply of U.S.-trained physicians alone, however, is not projected to reach that level until 1987. This finding again serves to dramatize the numerical impact of foreign-trained physicians.

As indicated earlier, alternative projections (high and low) were developed separately for both U.S.-and foreign-trained physicians. Although a matrix of possible combinations could be examined, the following discussion concerns itself with only two alternative projections of all active physicians—one consisting of the high projections for the two components and one consisting of the respective low projections.

Under the high methodology, the supply of all active physicians is projected to increase from 323,200 in 1970 to 459,900 in 1980 (a 42-percent increase) and then to 637,100 in 1990 (a 39-percent increase). Compared to results from the basic methodology, the high series projects an additional 43,300 physicians by 1990, of which approximately three-fifths are projected to result from the increased entry of foreign-trained physicians. The high methodology projects the proportion of foreign-trained to all active physicians to be 30 percent in 1990, compared to 28 percent in the basic projection.

In contrast, the low methodology projects the overall physician supply to reach 552,000 by 1990—a figure about 42,000 below the basic projection for that year and approximately the same number as in the 1985 high projection. Over the entire 20-year projection period, the low methodology projects the overall supply of physicians to grow by 71 percent, in contrast to a 84-percent increase in the basic approach, and the 97-percent increase under the high methodology.

Another means of assessment is afforded by an examination of the physician/population ratios projected by the basic methodology and the two alternatives. Under the basic approach, the ratio is projected to reach 237 per 100,000 population by 1990. This compares with a ratio of 254 per 100,000 population under the high alternative, and 220 per 100,000 under the low approach.

NOTE ON ESTIMATES OF "ACTIVE" M.D.'S

As noted in Table 12, as well as in certain other tables presented in this report, BHRD estimates of the number of active M.D.'s in 1971 and 1972 vary substantially from numbers published by the AMA[42]:

	Active physicians (M.D.)		
Year	BHRD estimate	AMA figure	Difference
1971.....	322,026	318,699	3,327
1972.....	332,530	320,903	11,627

In evaluating this apparent discrepancy, note should be made of the different definitions for "active" employed by the two organizations. The AMA active figure is defined as the number of professionally active M.D.'s whose address is known. Excluded from this number are those M.D.'s identified by the AMA in its information system as inactive, address unknown, or not classified.

In brief, the category "not classified" accounts for the BHRD-AMA differences in numbers of active M.D.'s. In 1971 and 1972, according to the AMA this category accounted for 3,529 and 12,356 M.D.'s, respectively. The AMA, to update its files between AMA census years, utilizes its weekly *Periodic Survey of Physicians* to obtain information on those M.D.'s that have been brought to the attention of AMA as evidencing some signs of change in their status—such as a termination of intern, residency, or Government service contract, or a notification of address change. If after three follow-up surveys the AMA receives no response, apparently the M.D.'s in question are placed in the "not classified" category. This procedure was initiated with 1970 AMA statistics and was still in effect by late 1973. In 1970, the number of M.D.'s in this category was only 358.

Given the objectives of this report—namely, to develop new or improved estimates of available manpower resources—the AMA definition of active M.D.'s was deemed too restrictive. According to AMA definitions, for example, the number of M.D.'s rose by only 2,200 between 1971 and 1972; yet, available data on medical school graduates and entry of foreign-trained physicians suggested a much larger increase.

BHRD's estimate was, however, derived from AMA data. The AMA's categories of "active" and "inactive" M.D.'s were used to calculate a proportionate active figure (i.e. roughly 94 percent). This proportion was applied to the "not classified" totals for 1971 and 1972, respectively, and the resultant figures were then added to the AMA "active" estimate to arrive at the BHRD figures. Technically, this procedure should have been undertaken for 1970 but, in view of the small number of physicians who were "not classified" (358), the entire "not classified" category was simply added to the AMA "active" figure.

The AMA recognizes the fact that a number of M.D.'s in the category "not classified" are indeed actively working; but the Association has no means at present of determining the magnitude of this group. Admittedly, the active proportion used by BHRD is an arbitrary assumption. Hopefully, later information collected by the AMA on M.D.'s generally and those currently "not classified" specifically will assist in resolving this apparent discrepancy.

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[42] Roback, G. A. Distribution of Physicians in the U.S., 1971. Chicago, American Medical Association, 1972. _____. Distribution of Physicians in the U.S., 1972. *Volume 1. Regional, State, County*. Chicago, American Medical Association, 1973.

Chapter 4 • MEDICAL SPECIALISTS (M.D.'S)

This chapter provides estimates and projections of the supply of M.D.'s engaged in particular specialties. Largely because of limitations in the available data, osteopathic physicians are not included in the analysis except at an occasional point.

The basic sources of data on the specialties of M.D.'s are the published reports of the American Medical Association (AMA), based on its master file of physicians and its periodic surveys of their activities. The AMA records classify physicians according to the specialty in which they spend the largest portion of their time. The physician is asked to designate his specialty or specialties from a given listing and to indicate the "number of hours spent per week" in each. The published categorizations reflect an allocation of each physician to the specialty in which he spends the greatest number of hours. Thus, a physician who designated his primary specialty as general practice would nonetheless be classified as an internist if he also indicated that he devoted the largest number of hours to internal medicine. As a result, the data may overestimate the number of specialists and, conversely, may underestimate the number of physicians engaged in general practice. Similarly, the reporting of a physician in a particular specialty does not necessarily mean that he spends all his time in that specialty.

The identification of M.D.'s by specialty may be done in various ways. One method of categorizing specialists is according to whether or not they are board-certified. The certified diplomate is one who has completed 1 to 5 years of residency training and has passed a specialty board examination. He may or may not be actively working, or even spending most of his time, in his field of certification.

Noncertified specialists are those who have acquired a specialty as a result of training or experience. This may come as the result of a physician being appointed to a particular service in a hospital which accords him increasing experience and responsibility in a specialty. Or, it may reflect his having worked as a specialist in one or another department of a hospital and then carrying over into his private practice the "specialist" status obtained through his earlier association with the hospital. Some specialists may also have spent 1 or 2 years in a particular service as a resident but failed to complete the residency requirements for certification. Other physicians may call themselves specialists even though they have had no hospital experience in a particular specialty. However, since detailed comprehensive and comparable data are available only under the AMA classification system, those data are used in this section. It should be noted further, that many physicians with completed residency training in a particular specialty are not board-certified. Thus, board certification alone is not a realistic guide to specialty designation.

The Bureau of Health Resources Development (BHRD) is sponsoring a number of studies on the specialty fields, particularly for use in developing requirement and supply projections. Anesthesia practices are being studied by a team at Case Western Reserve University to determine what types of manpower mixes are being or could be utilized. Harvard Medical School is conducting a major study on surgical services in the United States, funded in part by BHRD, to determine the types and frequency of all surgery being performed and the training and background of manpower involved. A study at the University of Washington is related to manpower in orthopedic surgery.

CURRENT CHARACTERISTICS AND TRENDS

Although there are more than 60 officially recognized specialties, only 21 have been included here for analysis. These were chosen either because of their numerical importance or for their potential growth.

As can be seen in Table 29, the largest number of M.D.'s are in general practice and in the specialties of internal medicine, general surgery, psychiatry, obstetrics and gynecology, and pediatrics. The smallest number are in therapeutic radiology, physical medicine and rehabilitation, thoracic surgery, and plastic surgery.

Foreign medical graduates (FMG's)[1] are distributed in much the same specialties as U.S. trained physicians; that is, largely in general practice and in the five major specialties cited above. However, there are proportionately fewer FMG's than graduates of American and Canadian schools in dermatology, ophthamology, and orthopedic surgery, and proportionately more FMG's in anesthesiology, pediatric cardiology, pathology, and physical medicine and rehabilitation. It is worth noting that FMG's tend to be more represented in the specialties that have high proportions of unfilled residency positions (excluding FMG's from such proportions) and to be less represented in the specialties with a small proportion of unfilled residency positions.

Specialists are distributed unevenly by geographic location, with States such as New York, Massachusetts,

[1] In view of the AMA inclusion of Canadian graduates with U.S. graduates in internship and residency data, all references to FMG's in this chapter exclude Canadians.

Table 29.

PERCENT DISTRIBUTION OF ACTIVE PHYSICIANS (M.D.) AND OF FIRST-YEAR RESIDENTS, BY SPECIALTY AND COUNTRY OF GRADUATION FROM MEDICAL SCHOOL: 1970

Specialty	Active physicians (M.D.) (December 31)				First-year residents (September 1)		
	Total	U.S. medical graduates	Canadian medical graduates	Other foreign medical graduates	Total	U.S. and Canadian medical graduates	Other foreign medical graduates
All active M.D.'s:							
Number	311,203	251,237	5,548	54,418	14,556	10,199	4,357
Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0
General practice[1]	18.6	20.1	13.9	12.4	1.9	0.5	2.1
Medical specialties	20.8	21.2	15.6	19.4	31.1	31.2	28.6
Dermatology	1.3	1.4	1.5	0.7	1.4	1.9	0.3
Internal medicine	13.5	13.9	9.4	11.7	20.9	21.6	19.3
Pediatrics[2]	6.1	5.9	4.7	7.0	8.1	7.8	11.2
Surgical specialties	27.5	28.1	28.6	22.9	36.3	38.1	32.8
General surgery	9.6	9.6	8.3	9.7	17.3	16.5	19.1
Neurological surgery	0.8	0.8	1.4	0.8	1.0	1.0	0.8
Obstetrics and gynecology	6.1	6.1	6.1	5.6	5.9	5.3	7.2
Ophthalmology	3.2	3.5	3.8	1.5	3.2	4.3	0.6
Orthopedic surgery	3.1	3.4	3.7	1.6	3.6	4.7	1.2
Otolaryngology	1.7	1.6	2.3	1.2	1.6	2.0	0.6
Plastic surgery	0.5	0.5	0.6	0.4	0.8	0.9	0.6
Thoracic surgery	0.6	0.6	0.5	0.7	0.9	1.0	1.0
Urology	1.9	2.0	1.9	1.4	2.1	2.3	1.8
Other specialties	33.3	30.6	41.9	45.4	30.6	29.2	36.0
Anesthesiology	3.5	2.9	4.7	6.1	4.7	3.3	8.0
Child psychiatry	0.7	0.6	1.4	0.8	1.2	1.3	1.0
Neurology	1.0	0.9	1.6	1.2	1.9	2.1	1.7
Psychiatry	6.8	6.2	10.2	9.2	9.5	10.3	7.7
Pathology	3.4	2.7	4.5	5.8	5.1	3.2	9.6
Physical medicine and rehabilitation	0.5	0.4	0.5	0.9	0.7	0.3	1.5
Radiology	3.4	3.6	3.2	2.6	6.2	7.3	3.8
Therapeutic radiology	0.3	0.3	0.3	0.4	0.2	0.3	0.2
Miscellaneous	13.7	13.0	15.5	18.3	0.9	1.1	0.5

[1] Includes family practice.
[2] Includes pediatric allergy and pediatric cardiology.

Source: Active physicians: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.
First-year residents: American Medical Association. *Director of Approved Internships and Residencies, 1971-72.* Chicago, The Association, 1971.

Vermont, Rhode Island, California, Connecticut, and Maryland having disproportionately large numbers. Examples of the variation in geographic distribution can clearly be seen in an examination of the physician/population ratios for California and Alaska. In California, there is 1 internist for every 3,500 persons, whereas in Alaska there is 1 per 14,400 persons. Similarly, there is 1 general surgeon per 7,100 persons in California compared to 1 per 12,500 persons in Alaska, and 1 pediatrician per 10,000 persons in California compared to 1 per 20,000 persons in Alaska.[2] Studies have also shown that internists, surgeons, and certain other specialists (particularly pediatricians, obstetricians and gynecologists, pathologists, and radiologists) tend to locate in larger cities, whereas these specialties are

[2] Mason, Henry R. Manpower Needs by Specialty. *Journal of the American Medical Association* 219: 1621-1626, March 20, 1972.

ur derrepresented in other areas. There is somewhat less variation in the physician/population ratios for general practitioners. Major contributing factors to location choice appear to be the presence or absence of hospitals and training facilities, the degree of urbanization, and per capita income levels in the area. There is evidence that the availability of residences has a strong positive relationship to the specialist supply because a substantial number of physicians remain in the area in which they receive their training. Studies on future practice locations of medical students indicate that there is also a direct relation between the attachment a student has to a particular area—for example, place of birth, education, or residency training—and the likelihood of locating in that area[3]. Not surprisingly, medical centers, hospitals, training facilities, and the like are heavily located in populous States, namely, New York, California, and Massachusetts—all of which have a disproportionately large number of physicians compared to the more sparsely populated States such as Idaho, Wyoming, Montana, Maine, and Alaska.

Individual specialties have shown very different growth patterns over time, evolving and growing in response to the particular scientific and intellectual interests of groups of individuals at particular points in time, rather than to any set plan. The oldest specialty is ophthalmology which developed around the ophthalmoscope in the 1850's and established the first certifying board in 1916. The specialty of radiology developed around the invention of the X-ray machine about 1900. Pediatrics grew out of individual interest in child care which was reinforced by the maternal and child welfare movements of the early 1900's. Overall, the AMA listed only 20 approved specialty fields in 1920. This original list of 20 specialties has more than tripled, and specialty boards now offer certification in about 65 different specialties, subspecialties, and special divisions. In 1931, only 10 percent of all physicians were engaged in specialty practice; by 1970, over 80 percent of all physicians were reported to be in a specialty.

There have been only relatively small changes in specialty distribution in recent years. Table 30 shows the specialty classification of M.D.'s over the 1963-72 period. In viewing the table, it should be kept in mind that the system used by the AMA to classify specialists was changed in 1968. In the pre-1968 classification procedure, the physician assigned himself to a particular specialty; in the new system, the specialty classification is determined by the number of hours the physician spends in a given specialty. For this report, the pre-1968 data have been adjusted (according to the percent difference between the two sets of data existing in 1968) so that the data shown are believed to be internally consistent.[4] Data prior to 1963, are not presented here because of other noncomparabilities, including the separation of specialists into full- and part-time categories.

As shown in Table 30, with the exception of general practice there has been little change in the composition of specialty manpower during the past 10 years, despite a net increase of nearly 71,000 active physicians over this period. The only specialties in which there has been an increase of more than 1 percentage point have been internal medicine and pediatrics. The proportion of all active physicians in internal medicine increased from 11.6 percent in 1963 to 15.0 percent in 1972. In pediatrics the proportion has changed from 4.9 percent to 6.4 percent.

The growth of pediatrics and internal medicine, which are often considered to be a part of primary care, has served to partially offset the decline in general practice, which fell from 26 percent of all physicians in 1963 to 17 percent in 1972. In absolute numbers, general practice has also declined (by about 2 percent a year), whereas the specialties as a group have grown by about 4 percent a year (compounded). Of all the specialties shown, the subspecialties of therapeutic radiology and child psychiatry have demonstrated the largest annual compounded growth rate (25 percent and 16 percent respectively); otolaryngology has shown the smallest annual growth rate (1 percent). The medical specialties as a group have grown faster than the surgical and other specialties. In the surgical group, the surgical specialties have grown more rapidly than general surgery.

In recognition of the decline in general practice in the face of continued needs in this field, the medical profession has recently attempted to encourage this type of medical care by developing the specialty of family practice, which was formally recognized in 1969. Family practice was originally conceived of as a specialty concerned with comprehensive, continuing health care of the individual in the context of his family, community, and society.

In the past most general practitioners were trained in rotating internship programs. Some received an additional 1 to 2 years of graduate training in general practice residencies. Their training was oriented toward episodic, hospital-based health care for the individual, rather than to a continuity of care for the individual as a member of the

[3] Weiskotten, H. G.; Wiggins, W. S.; Altenderfer, M. E.; Gooch, M.; and Tipner, A. Trends in Medical Practice. *Journal of Medical Education* 35: 1071-1121, December 1960.

[4] Thedore, C. N.; Haug, J. M.; Balfe, B. E.; Roback, G. A.; and Franz, E. J. *Reclassification of Physicians, 1968.* Chicago, American Medical Association, 1971.

Table 30

TREND DATA ON NUMBER OF ACTIVE PHYSICIANS (M.D.), BY SPECIALTY: DECEMBER 31, 1963-72

Specialty	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
All active M.D.'s	261,728	269,552	277,575	285,857	294,072	296,312	302,966	311,203	[1] (318,699)	[2] (320,903)
General practice[3]	66,874	65,861	64,943	63,903	61,605	61,578	58,919	57,948	(56,358)	(55,348)
Medical specialties	46,518	49,175	51,762	54,032	56,761	59,796	60,054	64,694	(70,269)	(72,728)
Dermatology	3,156	3,279	3,407	3,538	3,656	3,775	3,870	4,003	(4,149)	(4,227)
Internal medicine	30,434	32,230	33,892	35,315	37,077	38,532	38,258	41,872	(46,202)	(47,994)
Pediatrics[4]	12,928	13,666	14,463	15,179	16,028	17,489	17,926	18,819	(19,918)	(20,507)
Surgical specialties	67,005	69,687	72,473	75,466	78,316	81,113	82,246	85,375	(89,125)	(90,409)
General surgery	23,607	24,564	25,644	26,628	27,490	28,433	28,603	29,761	(30,897)	(30,989)
Neurological surgery	1,818	1,933	2,041	2,185	2,310	2,419	2,484	2,578	(2,721)	(2,753)
Obstetrics and gynecology	15,296	15,866	16,379	16,973	17,478	18,017	18,084	18,876	(19,770)	(20,202)
Ophthalmology	7,833	8,092	8,380	8,718	9,065	9,368	9,578	9,927	(10,252)	(10,443)
Orthopedic surgery	6,827	7,207	7,557	7,990	8,434	8,869	9,227	9,620	(10,121)	(10,356)
Otolaryngology	4,724	4,776	4,852	4,946	5,086	5,195	5,272	5,409	(5,592)	(5,662)
Plastic surgery	1,023	1,090	1,167	1,243	1,342	1,414	1,503	1,600	(1,688)	(1,786)
Thoracic surgery	1,296	1,374	1,474	1,622	1,720	1,822	1,857	1,809	(1,928)	(1,927)
Urology	4,581	4,785	4,979	5,161	5,391	5,576	5,638	5,795	(6,156)	(6,291)
Other specialties	81,331	84,829	88,397	92,456	97,390	93,825	101,747	103,186	(102,947)	(102,418)
Anesthesiology	7,593	8,124	8,592	9,055	9,572	10,112	10,434	10,860	(11,557)	(11,853)
Child psychiatry	751	980	1,154	1,353	1,525	1,702	1,898	2,090	(2,171)	(2,268)
Neurology	1,822	2,037	2,198	2,320	2,493	2,675	2,850	3,074	(3,317)	(3,494)
Psychiatry	15,551	16,377	17,333	18,290	19,137	19,907	20,328	21,146	(22,279)	(22,570)
Pathology[5]	7,016	7,557	8,106	8,560	9,090	9,696	10,023	10,483	(11,103)	(11,218)
Physical medicine and rehabilitation	991	1,096	1,162	1,222	1,294	1,407	1,415	1,479	(1,563)	(1,551)
Radiology[6]	7,211	7,530	7,949	8,396	8,963	11,718	12,367	13,360	(14,339)	(14,917)
Miscellaneous[7]	40,396	41,128	41,903	43,260	45,316	36,608	42,432	40,694	(36,618)	(34,547)

[1] Excludes 3,529 physicians "not classified". If the percent active among all physicians is applied to the "not classified" physicians, the estimated number of active physician would be 322,026.

[2] Excludes 12,356 physicians "not classified". If the percent active among all physicians is applied to the "not classified" physicians, the estimated number of active physicians would be 332,530.

[3] Includes family practice in 1970-72.

[4] Includes pediatric allergy and pediatric cardiology.

[5] Includes forensic pathology.

[6] Includes therapeutic radiology and diagnostic radiology.

[7] Includes physicians with unspecified specialty.

Source: Roback, G. A. *Distribution of Physicians in the U.S., 1972.* Chicago, American Medical Association, 1973. Also prior annual volumes.

Note: Due to a change in the A.M.A. classification procedure in 1968, there exists a discontinuity in the published series between the figures for 1963-67 and those for 1968-72. In this report the figures for 1963-67 have been adjusted to provide a comparable series using comparative data in: Theodore, C. N. et al. *Reclassification of Physicians, 1968.* Chicago, American Medical Association, 1971.

family. Thus, prior to the introduction of the concept of family practice, these programs traditionally placed minimal emphasis on health maintenance and comprehensive care.

Since its formal recognition, family practice has grown rapidly. As of September 1972, there were 151 approved residency training programs in the field, with approximately 1,040 residents in training. Thus, 59 percent of the available 1,755 openings were filled. Foreign medical graduates accounted for 12 percent of the filled residencies. At the present time, half of the Nation's medical schools have programs in family practice that are either operational or in the planning stages. However, concurrent with the growth of family practice, there has been a further decline in the numbers of physicians who indicate that they function as general practitioners. This decline has been reflected in the decrease in the number of filled general practice residencies. On July 1, 1970, there were 145 approved general practice residency training programs, with a capacity of 925 physicians. By July 1971, the number had dropped to only 133 programs with a capacity of 818 physicians. A high proportion of these residency positions were filled by FMG's. Although some of the general practice training programs have been converted to family practice programs, others have been terminated. General practitioners who wish to become board-certified in family practice must meet stated eligibility criteria and pass the certification examination. As in other specialties, information on the number of M.D.'s in family practice is collected by the AMA. Up to the present time, however, family practitioners have been included under "general practice" in the AMA's Distribution of Physicians series. According to data published by the AMA, 348 family practitioners were included in this broader designation in 1970 and 2,344 in 1971.[5] In the future, however, family practice will be listed as a separate specialty in the AMA's annual professional activity questionnaire, and consequently the number of family practitioners will appear as a separate line item in the Distribution of Physicians for 1973.

At this time, there is a discrepancy between the AMA statistics on family practice and those provided by the American Board for Family Practice. According to the latter, 1,690 physicians became board-certified family practitioners in 1970 (109 FMG's and 1,581 graduates of U.S. and Canadian medical schools), and 1,595 were so certified in 1971.[6] The difference between the Board and the AMA figures may reflect the mechanism used by the AMA in classifying practitioners according to the number of hours they report as being worked within a specialty. For example, an M.D. reporting 23 hours a week worked in internal medicine and 17 hours in family practice would be listed by AMA in internal medicine.

Despite the growth in popularity of family practice in recent years, its future remains uncertain. Factors that have contributed to its growth and potential for success include medical student interest, the further organization of ambulatory care with the continued development of health centers, and the demand by the public for a clearly identifiable point of entry into the health care system and personal health services. However, among the possible offsetting concerns that may limit the growth in family practice are the public's tendency toward self-referral to specialties, conflicting attitudes of the practicing and academic community, and large numbers of hospitals that are oriented more towards curing than preventing.

The growth of specialization at the expense of general practice is the result of many influences. One major factor is the vast increase in medical knowledge which has made it virtually impossible for any single individual to be skilled in all phases of applied medicine. Furthermore, newly emerging fields of knowledge are often attractive areas of study for both young and experienced physicians. The changing economic and social conditions have also provided incentives for specialty practice. Physicians beginning practice after World War II entered an era in which the rising expectations of the population created a demand for a more sophisticated level of medical care than had previously been available. A number of physicians who started in general practice have shifted to practice in newer specialties as a result of these factors. Another reason for growth in the specialties is that specialization allows some physicians to maximize their income and minimize the demands on their time.

The growth of medical specialization may also be attributed to factors inherent, in part, in the organization of medical education. For example, it is the responsibility of medical schools to select their students, determine their curricula, and ultimately graduate M.D.'s. During their training, these students receive a considerable amount of instruction from laboratory-oriented specialists on a sample of patients not totally representative of the general population. Few medical school faculty members have been general practitioners themselves; consequently, there often tends to be less emphasis on general practice and more on hospital practice. The patients utilized for the training of medical students tend to be indigent and to have multiple social and emotional problems; thus most patients seen by students are not broadly representative of medical practice in the community. Available data indicate that many

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[5] American Medical Association. *Profile of Medical Practice.* 1972 edition. Chicago, The Association, 1972.

[6] Personal communication to Dr. Robert Knouss, Division of Physician and Health Professions Education, DHEW, NIH, BHME.

Table 31.

CHANGES IN THE SUPPLY OF ACTIVE PHYSICIANS (M.D.), BY SPECIALTY: SELECTED YEARS 1963-90

Specialty	1963-70		1970-80		1980-90	
	Number of physicians (M.D.)	Yearly percent change[1]	Number of physicians (M.D.)	Yearly percent change[1]	Number of physicians (M.D.)	Yearly percent change[1]
Total active physicians	49,480	2.5	119,030	3.3	140,790	2.9
General practice	−10,620	−2.1	−9,050	−1.5	−10,510	−2.0
Medical specialties	18,180	4.8	44,370	5.2	52,490	3.9
Dermatology	850	3.4	1,660	3.5	2,090	3.2
Family practice[2]	—	—	1,230	5.6	1,530	4.2
Internal medicine	11,440	4.6	29,150	5.4	34,600	4.0
Pediatrics[3]	5,890	5.5	12,320	5.1	14,270	2.7
Surgical specialties	18,370	3.5	48,170	4.5	57,320	3.5
General surgery	6,150	3.3	25,250	6.3	29,570	4.4
Neurological surgery	760	5.1	1,220	3.9	1,460	3.3
Obstetrics and gynecology	3,580	3.0	6,970	3.2	8,120	2.8
Ophthalmology	2,090	3.4	3,520	3.0	4,480	2.9
Orthopedic surgery	2,790	5.0	4,430	3.8	5,530	3.3
Otolaryngology	680	2.0	1,760	2.8	2,190	2.7
Plastic surgery	580	6.5	1,140	5.5	1,380	4.1
Thoracic surgery	510	4.8	1,200	5.1	1,390	3.9
Urology	1,210	3.4	2,660	3.8	3,200	3.2
Other specialties	23,550	3.7	35,530	3.0	41,490	2.6
Anesthesiology	3,270	5.2	6,650	4.9	7,450	3.6
Child psychiatry	1,340	15.7	1,760	6.3	2,110	4.4
Neurology	1,250	7.7	2,870	6.8	3,410	4.7
Psychiatry	5,600	4.4	12,920	4.9	15,410	3.8
Pathology	3,310	5.7	7,520	5.6	8,350	3.9
Physical medicine and rehabilitation	490	5.9	1,020	5.3	1,110	3.7
Radiology	3,360	5.6	8,910	6.3	10,780	4.5
Therapeutic radiology	690	25.0	260	2.6	310	2.4
Miscellaneous	4,240	1.4	−6,400	−1.4	−7,440	−1.9

[1] Average annual compound change rate.
[2] Family practice not reported before 1970.
[3] Includes pediatric allergy and pediatric cardiology.

Source: 1963 physicians: Theodore, C. N. and Haug, J. N. *Selected Characteristics of the Physician Population, 1963 and 1967.* Chicago, American Medical Association, 1968.
1970, 1980, and 1990 physicians: Table 34.

Note: Figures may not add to totals and subtotals due to independent rounding.

students do show interest in general practice at the onset of their training period, but this interest gradually diminishes as their training progresses. With the advent of family practice, these aspects of medical education are becoming somewhat ameliorated.

Looked at another way, however, the decline in the number of general practitioners does not necessarily represent a decline in the number of physicians providing primary care. The functions of general practice have shifted partially to the specialties of internal medicine, pediatrics, and obstetrics, perhaps by default. According to limited data assembled by the National Disease and Therapeutic Index (NDTI), it appears that about 80 percent of the work of internists and pediatricians is similar to that of general practitioners. Referred patients constitute only about 8 percent of pediatric practice, 26 percent of internal

medicine practice, and 19 percent of obstetric-gynecologist practice.[7]

If the groups mentioned above are combined into a primary care category, the picture vis-a-vis general practice changes substantially. On this basis, the number of "primary care" physicians (those in general practice, family practice, internal medicine, pediatrics, and obstetrics and gynecology) actually increased between 1963 and 1970 (from 125,530 to 137,520), although the proportion they make up of all physicians fell from 48 to 44 percent.

Another contribution to the divergent growth rates of medical specialties and a major aspect of the health care system in the United States is the system of providing hospital residencies. There are far more residency training positions available in hospitals than there are medical school graduates to fill them. In effect there are few barriers to a medical school graduate entering the specialty of his choice.

As can be seen in Tables 32 and 33, there were only minor changes in the distribution of physicians in first-year residencies and in all residencies during the period 1960-71. This is especially noteworthy in view of the fact that there were 12,800 more physicians in residency training in 1971 than in 1960.

Three specialties, however, have shown a different pattern. The proportion of residents in general surgery decreased from 20 percent of all residents in 1960 to 15 percent in 1971. (See Table 33.) A decline also took place in obstetrics-gynecology; in 1960, 9 percent of all residents in training were in obstetrics and gynecology, whereas in 1971 the percentage was 7 percent. In contrast, radiology residents increased as a proportion of the total, from 5 percent in 1960 to 8 percent in 1971. This trend is even more interesting in view of the fact that radiology residencies are not entered by FMG's in large numbers. Only one out of every five radiology residents in 1971 was an FMG, whereas more than one out of every three general surgery residents was an FMG.

The pattern of residencies shows the marked impact that FMG's have had on specialty training. Between 1965, the earliest year for which detailed data on FMG's are available, and 1971, the number of FMG's in residency training grew from 9,121 to 13,520, or from 29 percent of the total to 32 percent. Four specialists show especially marked changes for FMG's—general practice, psychiatry, internal medicine, and general surgery. In 1965, 4 percent of all FMG residents were in general practice, but by 1971 the proportion (including family practice) dropped to 1 percent. Similarly, the percentage of all FMG residents in general surgery dropped from 21 to 18 percent during the period, and the proportion of all FMG residents who were in psychiatry fell from 10 percent to 8 percent. On the other hand, FMG residents in internal medicine increased from 17 percent of total FMG residents in 1965 to 20 percent in 1971. (See Table 32.)

[7] Kozlow, D. A. ed. *Specialty Profile.* National Disease and Therapeutic Index. Ambler, Pa., 1972. The NDTI is a service of Lea, Inc. and is a continuing study of private medical practice in the United States, begun in 1965. Data are obtained from a representative panel of physicians, who report case history information on private patients over a given period of time. All information is recorded on tapes by Lea, Inc., and both monthly and quarterly reports are generated.

PROJECTIONS OF THE SUPPLY OF M.D.'S BY SPECIALTY TO 1990

METHODOLOGY AND ASSUMPTIONS

The basic methodology used to project the future supply of active specialists was to determine the number of specialists active in December 1970 who would still be active in 1975, 1980, 1985, and 1990, and then to estimate the specialty of the new additions to the active supply during the 20-year period. In all instances, the projections were controlled to the independently derived "basic" projection of active M.D.'s described in Chapter 3. The following sections describe the projection methodology in more detail.

The basic projection of M.D.'s provided estimates of the total number of active M.D.'s in 1970 who would still be active by 1975, 1980, 1985 and 1990. These "1970-survival" estimates were developed separately for two groups—graduates of U.S. and Canadian medical schools, and foreign medical school graduates. The survivor total was then distributed according to the 1970 specialty distribution of active M.D.'s for each 5-year interval over the 1970-period; the distribution was made separately for U.S. and Canadian M.D.'s and for foreign medical graduates. In the case of family practice, the data from the American Board of Family Practice providing 1970 estimates for family practitioners were used in lieu of AMA data, largely because the Board's numbers appeared to reflect more realistically the current situation in family practice. Because most of these newly certified diplomates of family practice were originally general practitioners, the 1970 estimate of general practitioners used in these projections was the AMA total of general practitioners minus the family practice diplomate estimate. This provided an estimate of the number of active M.D.'s in individual specialties in 1970 who would still be active in each of the relevant future time periods. This approach implicitly assumes that separation rates utilized for all

Table 32.

TREND IN FIRST-YEAR RESIDENTS, BY SPECIALTY: SELECTED YEARS SEPTEMBER 1, 1960-71

Specialty	1960	1961	1962	1967	1968	1970	1971
Total first-year residents	11,070	10,923	10,627	12,581	12,721	14,556	15,181
General practice	364	316	242	265	256	144	146
Medical specialties	3,188	3,267	3,191	3,706	3,853	4,664	5,050
Dermatology	102	128	135	183	166	205	207
Family practice[1]	–	–	–	–	–	131	301
Internal medicine	2,193	2,284	2,171	2,417	2,589	3,044	3,166
Pediatrics[2]	893	855	885	1,106	1,098	1,284	1,376
Surgical specialties	4,274	4,227	4,151	4,790	4,748	5,290	5,225
General surgery	2,122	2,057	2,039	2,406	2,394	2,514	2,400
Neurological surgery	101	121	103	116	119	141	141
Obstetrics and gynecology	917	859	793	783	759	857	911
Ophthalmology	288	312	356	397	418	460	454
Orthopedic surgery	353	368	256	421	403	528	515
Otolaryngology	153	155	167	208	206	234	245
Plastic surgery	47	53	70	77	90	120	134
Thoracic surgery	89	102	101	126	137	125	133
Urology	204	200	207	256	222	311	292
Other specialties	3,244	3,113	3,043	3,820	3,864	4,458	4,760
Anesthesiology	550	550	515	612	677	688	769
Child psychiatry	28	65	79	147	118	178	214
Neurology	149	177	163	233	249	283	338
Psychiatry	1,090	1,082	1,121	1,246	1,209	1,388	1,396
Pathology	757	655	607	704	661	744	802
Physical medicine and rehabilitation	55	61	52	109	95	101	110
Radiology[3]	544	514	498	755	849	941	852
Miscellaneous	71	9	8	14	6	135	279

[1] Family practice residencies not reported before 1970.
[2] Includes pediatric allergy and pediatric cardiology.
[3] Includes therapeutic radiology.

Source: American Medical Association. *Directory of Approved Internships and Residencies, 1972-73.* Chicago, The Association, 1972; also prior annual issues.

active M.D.'s are representative of the patterns for individual specialists, an assumption which was necessary in the absence of detailed data for the specialties.

The basic M.D. projection also provided estimates of the net additions to the active supply of physicians in the coming 20 years—graduates from U.S. and Canadian schools and from foreign medical schools. To obtain the specialty distribution of new entrants to the physician pool, the 1970 percentage distribution of first-year residents by specialty—again separately for the two groups of M.D.'s—was applied to the number of net entrants for each 5-year period over 1970-90.[8] This approach implicitly assumed that the 1970 distribution of residents would represent their ultimate specialty choice and that the 1970 pattern of residences would continue into the future.

The first step described above estimated the number of survivors over the 20-year period, while the second step estimated the number of new additions to the supply over the period. These two sets of figures were then aggregated to provide the overall projections of the future supply of active M.D.'s by specialty.

In any evaluation of this methodology, several concerns should be noted:

1. The simplified methodology used to develop the specialty projections largely reflects the lack of sufficient and consistent trend data on residency training in all of the specialties. Ideally, each specialty should be projected

[8] American Medical Association. *Directory of Approved Internships and Residencies, 1971-72.* Chicago, The Association, 1971.

Table 33.

TREND IN TOTAL RESIDENTS AND OF FMG RESIDENTS, BY SPECIALTY: SEPTEMBER 1, 1960, 1965, AND 1971

Specialty	Number of residents					Percent distribution				
	Total			Foreign medical graduates[1]		Total			Foreign medical graduates[1]	
	1960	1965	1971	1965	1971	1960	1965	1971	1965	1971
Total residents	28,356	31,700	42,293	9,121	13,520	100.0	100.0	100.0	100.0	100.0
General practice	549	494	246	326	171	1.9	1.6	0.6	3.6	1.3
Medical specialties	7,245	8,145	12,191	2,482	4,041	25.6	25.7	28.8	27.2	29.9
Dermatology	298	420	621	50	52	1.1	1.3	1.5	0.5	0.4
Family practice[2]	—	—	632	—	68	—	—	1.5	—	0.5
Internal medicine	5,197	5,600	7,869	1,564	2,771	18.3	17.7	18.6	17.1	20.5
Pediatrics[3]	1,750	2,125	3,069	868	1,150	6.2	6.7	7.3	9.5	8.5
Surgical specialties	12,115	13,487	16,370	3,399	4,619	42.7	42.5	38.7	37.3	34.2
General surgery[4]	5,640	6,024	6,435	1,953	2,431	19.9	19.0	15.2	21.4	18.0
Neurosurgery	369	482	595	81	129	1.3	1.5	1.4	0.9	1.0
Obstetrics and gynecology	2,517	2,526	2,800	682	1,114	8.9	8.0	6.6	7.5	8.2
Ophthalmology	807	1,054	1,403	97	116	2.8	3.3	3.3	1.1	0.9
Orthopedic surgery	1,262	1,501	2,572	194	234	4.5	4.7	6.1	2.1	1.7
Otolaryngology	525	680	960	80	158	1.9	2.1	2.3	0.9	1.2
Plastic surgery	135	184	279	39	59	0.5	0.6	0.7	0.4	0.4
Thoracic surgery	179	226	277	85	119	0.6	0.7	0.7	0.9	0.9
Urology	681	810	1,049	188	259	2.4	2.6	2.5	2.1	1.9
Other specialties	8,447	9,574	13,486	2,914	4,689	29.8	30.2	31.9	31.9	34.7
Anesthesiology	1,244	1,185	1,844	550	992	4.4	3.7	4.4	6.0	7.3
Child psychiatry	79	334	528	75	134	0.3	1.1	1.2	0.8	1.0
Neurology	342	562	854	137	252	1.2	1.8	2.0	1.5	1.9
Pathology[5]	1,985	2,098	2,554	832	1,409	7.0	6.6	6.0	9.1	10.4
Physical medicine and rehabilitation	153	199	311	87	185	0.5	0.6	0.7	1.0	1.4
Psychiatry	3,107	3,565	4,085	945	1,098	11.0	11.2	9.7	10.4	8.1
Radiology[6]	1,537	1,631	3,310	288	619	5.4	5.1	7.8	3.2	4.6

[1] Excluding Canadian graduates.
[2] Family practice residencies were not reported before 1970.
[3] Includes pediatric allergy and pediatric cardiology.
[4] Includes rectal and colon surgery.
[5] Includes forensic pathology.
[6] Includes diagnostic and therapeutic radiology.

Source: *Directory of Approved Internships and Residencies 1972-73.* Chicago, American Medical Association, 1972. Also 1961 and 1965 editions.

Note: Figures may not add to totals and subtotals due to independent rounding.

separately, taking into account the trends in residencies and the relationship of residency training to specialty entered. However, the technique of utilizing the current percentage distribution of residencies to develop individual specialty totals was necessary because of time and data constraints. It is true, however, that increasing numbers of physicians may choose specialties which are relatively undersupplied, responding perhaps to their own as to where their services are needed, government inducements, and/or economic self-interest. The experience of family practice is a good case in point. In 1965, with the declining number of physicians entering general practice, it would have been hard to predict the popularity family practice is experiencing in 1970, 1971 and 1972.

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2. Data on the number of first-year, rather than total, residencies were used, even though specialties differ in the amount of residency training required; years of training vary from one to five.

3. The use of first-year residency distribution may involve some double counting. For example, a physician may complete a residency program in pediatrics in 1965 and be counted as an active practicing physician in 1970, even though he may also at that time be acquiring a year of residency training in pediatric cardiology (thereby being counted again as a first-year resident).

4. Another possible double counting may occur in some of the subspecialties (namely, neurosurgery, plastic surgery, thoracic surgery, child psychiatry, and therapeutic radiology) because first-year residencies in general surgery, psychiatry, and radiology can be used for meeting certification requirements in the subspecialties. For example, physicians intending to become thoracic surgeons are counted at two points in their training: at the point of their first-year residency in general surgery and at the point of their first-year residency in thoracic surgery.

5. There are virtually no data on the number of FMG's who complete particular types of residency training and then leave the country. Since FMG's are more likely to fill vacant residency training positions than those of their choice, there is a greater likelihood that their specialty field of practice after residency may not be the same as their residency field. Furthermore, many FMG's enter the United States after having completed specialty training in their home country.

6. The methodology fails to account for those medical school graduates who do not enter residency training programs at all, although this is a very small number.

7. Nonapproved residency and internship programs are not listed in basic reference sources on first-year residencies and consequently are excluded from these projections. Among the individual specialties, psychiatry is expected to be most affected, since considerable numbers of FMG's are in unapproved psychiatric training programs in State mental hospitals.

8. Detailed and definitive data on the relationship between residency training and type of practice are lacking. For example, of 1,900 aerospace medicine physicians, only 5 percent have completed formal residency programs in aerospace medicine, and only 18 percent are board-certified.[9]

[9] Ellingson, H. V. Training in Aerospace Medicine. *Aerospace Medicine.* Vol. 39, No. 9, Section II, pp. 1-28, September 1968.

PROJECTION FINDINGS

Utilizing the basic methodology, the number of active M.D.'s is expected to increase by about three-fourths between 1970 and 1990, or by about 2.8 percent a year (compounded). As can be seen in Table 34, general practitioners will continue the numerical decline already in evidence in recent years; their numbers are expected to fall from 56,260 in 1970 to 36,700 in 1990, with a somewhat faster decline in the second decade of the period. However, the primary care needs of the population should not be affected as much as this decline implies, since the primary care specialties of internal medicine, family practice, and pediatrics are all expected to grow.

Limited data exist as to how much time physicians in these particular specialties devote to primary care. As previously noted, a conservative estimate would be at least 80 percent. D.O.'s must be added to M.D.'s in primary care, however, to get a better picture of the total manpower involved. As of December 31, 1970, there were about 12,000 active D.O.'s in practice, with at least 75 percent estimated to be delivering primary care. In recent years, the number of States licensing D.O.'s has increased from 35 in 1965 to 49 in 1972. Given this development, it is likely that the geographic distribution of D.O.'s will become somewhat more dispersed during the next two decades.

Recently there has been a dramatic increase in the number of osteopathic physicians who are pursuing specialty training through two routes. First, the number of specialty training positions in osteopathic hospitals has been increasing sharply. Second, young physicians with D.O. degrees can now enter the approved training programs which were formally reserved for those with M.D. degrees. As of April 1972, there were about 1,380 specialists certified by the AOA; 1,400 osteopaths who spent part of their time in specialty practice; and 1,646 who were full-time specialists. Despite these considerations, however, the frequency with which D.O. graduates enter general practice will in all likelihood remain considerably greater than that for M.D. graduates.

Over the next two decades, the medical specialty fields are projected to continue to grow more rapidly than the surgical or other specialties. The growth in family medicine and internal medicine is projected to be especially rapid in the years ahead, with internal medicine increasing from 41,870 in 1970 to 105,620 in 1990 and family practice increasing from 1,690 in 1970 to 4,450 in 1990. (See Table 34.) However, since the future of family practice is still somewhat in doubt, these projections must be viewed carefully.

Table 34.

NUMBER OF ACTIVE PHYSICIANS (M.D.) ENGAGED IN PRIMARY CARE: ACTUAL 1963 AND 1970; PROJECTED 1980 AND 1990

Activity and specialty	Number of physicians (M.D.)				Percent distribution			
	1963[1]	1970	1980	1990	1963	1970	1980	1990
Total active physicians	261,730	311,200	430,240	571,030	100.0	100.0	100.0	100.0
Physicians in primary care	125,530	137,520	178,140	226,150	48.0	44.2	41.2	39.3
General practice	66,870	[2] 56,260	47,210	36,700	25.6	18.1	10.9	6.4
Family practice	N.A.	1,690	2,920	4,450	–	0.5	0.6	0.7
Internal medicine	30,430	41,870	71,020	105,620	11.6	13.5	16.5	18.4
Pediatrics[3]	12,930	18,820	31,140	45,410	4.9	6.0	7.2	7.9
Obstetrics and gynecology	15,300	18,880	25,850	33,970	5.9	6.1	6.0	5.9
Physicians in all other activities	136,200	173,680	252,100	344,880	52.0	55.8	58.8	60.7

[1] See table 30 for explanation of adjustment of these figures.
[2] Excludes 1,690 diplomates in family practice who have been shown separately.
[3] Includes pediatric allergy and pediatric cardiology.

Source: 1963: Theodore, C. N. and Sutter, G. E. *Distribution of Physicians in the U.S., 1963.* Chicago, American Medical Association, 1967.
1970: Haug, J. N.; Roback, G. A.; and Martin, B. C. *Distribution of Physicians in the United States, 1970.* Chicago, American Medical Association, 1971.

For reasons previously mentioned, the 1970 active base for family practice was determined by the 1970 number of family practice board certifications, rather than by the AMA statistics. A drawback to this approach is the fact that this active base is increasing not only because there are more graduate additions but also because there is an increase in the number of practicing physicians receiving board certification in family practice. This number increased from 1,690 in 1970 to 3,250 in 1971 and to 4,542 in 1972.[10] Most of these physicians are general practitioners who are converting to family practice. Consequently, the 1970 active base for general practice is decreasing not simply through deaths and retirements but also through conversions. Furthermore, the graduate additions for family practice may be underestimated using this methodology because increasing numbers of physicians are electing to do residency training in family practice. For example, between 1970 and 1972, the number of first-year residents increased from 131 to 494. If these increases continue our projections for family practice will be too low. However, for reasons previously mentioned, we are not sure that family practice will maintain its current popularity.

[10] American Medical Association. *Profile of Medical Practice.* 1973 edition. Chicago, The Association, 1973.

Obstetrics-gynecology is projected to show the slowest growth of the primary care specialties. (See Table 34.) This may be partially a reflection of the recently declining birth rate. However, it should be noted that the trend data in obstetrics-gynecology show marked fluctuations in numbers of physicians. Taken together, consequently, these four specialties, plus general practice, are projected to increase by nearly 90,000 by 1990, although as a proportion of all M.D.'s they will still drop from 44 percent to 39 percent.

Although the projections in table 35 suggest a sharp increase in the number of M.D.'s in surgical specialties, from 85,380 to 190,870 over the projection period, the inclusion of some implied assumptions might not argue for such an increase. In this regard, different opinions and concerns have recently been expressed concerning the possible "overcrowdedness" of the field, a factor which largely formed the rationale for the ongoing Study of Surgical Services in the United States mentioned above.

The projections are strongly influenced by the different medical specialty choices of U.S. and Canadian physicians and of foreign medical graduates. As can be seen in Table 36, six specialties most clearly illustrate the FMG impact. In 1970, 12 percent of all FMG's were in general practice, whereas only 4 percent of the FMG's are projected to be in this field in 1990. Internal medicine demonstrates an opposite movement, with 12 percent of the FMG's in the

Table 35.

SUPPLY OF ACTIVE PHYSICIANS (M.D.), BY SPECIALTY: ACTUAL 1970; PROJECTED 1980 AND 1990

Specialty	Number of physicians (M.D.)			Percent distribution		
	1970	1980	1990	1970	1980	1990
Total active physicians	311,210	430,240	571,030	100.0	100.0	100.0
General practice	[1] 56,260	47,210	36,700	18.1	11.0	6.4
Medical specialties	66,380	110,750	163,240	21.3	25.7	28.6
Dermatology	4,000	5,660	7,750	1.3	1.3	1.4
Family practice	1,690	2,920	4,450	0.5	0.7	0.8
Internal medicine	41,870	71,020	105,620	13.5	16.5	18.5
Pediatrics[2]	18,820	31,140	45,410	6.0	7.2	8.0
Surgical specialties	85,380	133,550	190,870	27.4	31.0	33.4
General surgery	29,760	55,010	84,580	9.6	12.8	14.8
Neurological surgery	2,580	3,800	5,260	0.8	0.9	0.9
Obstetrics and gynecology	18,880	25,850	33,970	6.1	6.0	5.9
Ophthalmology	9,930	13,450	17,930	3.2	3.1	3.1
Orthopedic surgery	9,620	14,050	19,580	3.1	3.3	3.4
Otolaryngology	5,410	7,170	9,360	1.7	1.7	1.6
Plastic surgery	1,600	2,740	4,120	0.5	0.6	0.7
Thoracic surgery	1,810	3,010	4,400	0.6	0.7	0.8
Urology	5,800	8,460	11,660	1.9	2.0	2.0
Other specialties	103,190	138,720	180,210	33.2	32.2	31.6
Anesthesiology	10,860	17,510	24,960	3.5	4.1	4.4
Child psychiatry	2,100	3,830	5,970	0.7	0.9	1.0
Neurology	3,070	5,940	9,350	1.0	1.4	1.6
Psychiatry	21,150	34,070	49,480	6.8	7.9	8.7
Pathology	10,280	17,800	26,150	3.3	4.1	4.6
Physical medicine and rehabilitation	1,480	2,500	3,610	0.5	0.6	0.6
Radiology	10,520	19,430	30,210	3.4	4.5	5.3
Therapeutic radiology	870	1,130	1,440	0.3	0.3	0.3
Miscellaneous	42,860	36,460	29,020	13.8	8.5	5.1

[1] Excludes 1,690 diplomates in family practice who have been shown separately.
[2] Includes pediatric allergy and pediatric cardiology.

Source: 1970 physicians: Haug, J. N.; Roback, G. A.; and Martin, B. C. *Distribution of Physicians in the United States, 1970.* Chicago, American Medical Association, 1971.
1970 diplomates in family practice: *Directory of Approved Internships and Residencies, 1971-72.* Chicago, American Medical Association, 1971.

Note: Figures may not add to totals and subtotals due to independent rounding.

specialty in 1970 compared with 18 percent in 1990. In pediatrics, the proportion is projected to increase from 7 percent to 10 percent. There will be an increase in the proportion of all FMG's who are general surgeons, from 10 percent in 1970 to 17 percent in 1990. (It should be kept in mind, however, that the general surgery numbers are influenced by the problem of double counting previously indicated.) Pathology is also projected to increase in proportion, from 6 percent to 9 percent. Finally, psychiatry is projected to exhibit a small decline in popularity among FMG's, with the proportion of all FMG's in psychiatry decreasing from 9 percent in 1970 to 8 percent in 1990.

For U.S. and Canadian trained physicians, the changes in distribution among specialties will be less dramatic than that evidenced by foreign medical graduates, although in essentially the same fields. The proportion of all U.S. and Canadian trained physicians who engage in general practice is projected to decline from 19 percent in 1970 to 7 percent in 1990. (See Table 37.) This means that there will be almost 20,000 fewer U.S. and Canadian general practitioners in 1990 than in 1970. As was true in the case of

Table 36.

SUPPLY OF ACTIVE FOREIGN TRAINED PHYSICIANS (M.D.), BY SPECIALTY: ACTUAL 1970; PROJECTED 1980 AND 1990

Specialty	Number of foreign trained[1] physicians (M.D.)			Percent distribution		
	1970	1980	1990	1970	1980	1990
Total active physicians	54,420	104,420	154,420	100.0	100.0	100.0
General practice	[2] 6,630	6,900	6,900	12.2	6.6	4.4
Medical specialties	10,660	27,080	43,810	19.4	25.9	28.3
Dermatology	390	500	610	0.7	0.4	0.3
Family practice	110	250	400	0.2	0.2	0.2
Internal medicine	6,370	16,610	27,060	11.7	15.9	17.5
Pediatrics[3]	3,790	9,710	15,750	7.0	9.3	10.1
Surgical specialties	12,410	29,630	47,120	22.9	28.3	30.5
General surgery	5,290	15,570	26,100	9.7	14.9	16.8
Neurological surgery	410	790	1,210	0.8	0.7	0.7
Obstetrics and gynecology	3,060	6,790	10,560	5.6	6.5	6.8
Ophthalmology	810	1,020	1,210	1.5	0.9	0.7
Orthopedic surgery	880	1,430	1,970	1.6	1.3	1.2
Otolaryngology	640	920	1,180	1.2	0.8	0.7
Plastic surgery	210	500	790	0.4	0.4	0.5
Thoracic surgery	370	910	1,460	0.7	0.8	0.9
Urology	740	1,640	2,660	1.4	1.6	1.7
Other specialties	24,720	40,800	56,590	45.5	39.0	36.6
Anesthesiology	3,300	7,460	11,670	6.1	7.1	7.5
Child psychiatry	430	930	1,450	0.8	0.8	0.9
Neurology	620	1,500	2,400	1.2	1.4	1.5
Psychiatry	5,030	8,770	12,480	9.2	8.4	8.0
Pathology	3,130	8,230	13,440	5.8	7.8	8.7
Physical medicine and rehabilitation	500	1,320	2,150	0.9	1.2	1.3
Radiology	1,410	3,400	5,420	2.6	3.2	3.5
Therapeutic radiology	210	300	380	0.4	0.2	0.2
Miscellaneous	10,090	8,880	7,190	18.5	8.5	4.6

[1] Excludes Canadian trained physicians.
[2] Excludes 110 diplomates in family practice who have been shown separately.
[3] Includes pediatric allergy and pediatric cardiology.

Source: 1970 foreign trained physicians: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.
1970 diplomates in family practice: *Directory of Approved Internships and Residencies, 1971-72.* Chicago, American Medical Association, 1971.

Note: Figures may not add to totals and subtotals due to independent rounding.

FMG's, the proportion of all U.S. and Canadian physicians in internal medicine is projected to increase from 14 percent in 1970 to 19 percent in 1990. A smaller increase is also projected to occur in another primary care specialty, pediatrics. The increases in these primary care specialties may partly reflect the gradual replacement of general practitioners by the specialists in internal medicine, pediatrics, and family practice. The proportion of all U.S. and Canadian physicians who are in general surgery is also projected to rise, from 10 percent in 1970 to 14 percent in 1990. (However, it should be remembered that the surgery figures may be somewhat inflated due to the double-counting problem.) In radiology, the proportion is projected to increase from 4 percent in 1970 to 6 percent in 1990.

Finally, in psychiatry, an interesting shift of U.S. and Canadian graduates vs. FMG physicians is projected to occur. Offsetting a decline in the popularity of psychiatry

Table 37.

SUPPLY OF ACTIVE UNITED STATES AND CANADIAN TRAINED PHYSICIANS (M.D.), BY SPECIALTY: ACTUAL 1970; PROJECTED 1980 AND 1990

Specialty	Number of United States and Canadian trained physicians (M.D.)			Percent distribution		
	1970	1980	1990	1970	1980	1990
Total active physicians	256,790	325,820	416,610	100.0	100.0	100.0
General practice	[1] 49,630	40,310	29,800	19.3	12.4	7.2
Medical specialties	55,720	83,670	119,420	21.7	25.7	28.7
Dermatology	3,620	5,160	7,140	1.4	1.6	1.7
Family practice	1,580	2,670	4,050	0.6	0.8	1.0
Internal medicine	35,500	54,410	78,570	13.8	16.7	18.9
Pediatrics[2]	15,030	21,430	29,670	5.9	6.6	7.1
Surgical specialties	72,970	103,920	143,760	28.4	31.9	34.5
General surgery	24,480	39,440	58,480	9.5	12.1	14.0
Neurological surgery	2,170	3,010	4,100	0.8	0.9	1.0
Obstetrics and gynecology	15,810	19,060	23,410	6.2	5.8	5.6
Ophthalmology	9,120	12,430	16,720	3.6	3.8	4.0
Orthopedic surgery	8,740	12,620	17,610	3.4	3.9	4.2
Otolaryngology	4,770	6,250	8,170	1.9	1.9	2.0
Plastic surgery	1,390	2,240	3,330	0.5	0.7	0.8
Thoracic surgery	1,440	2,100	2,940	0.6	0.6	0.7
Urology	5,060	6,770	9,000	2.0	2.1	2.2
Other specialties	78,480	97,920	123,620	30.6	30.1	29.7
Anesthesiology	7,560	10,050	13,290	2.9	3.1	3.2
Child psychiatry	1,670	2,930	4,520	0.7	0.9	1.1
Neurology	2,450	4,440	6,950	1.0	1.4	1.7
Psychiatry	16,120	25,300	37,000	6.3	7.8	8.9
Pathology	7,150	9,570	12,710	2.8	2.9	3.1
Physical medicine and rehabilitation	980	1,180	1,460	0.4	0.4	0.4
Radiology	9,120	16,040	24,800	3.6	4.9	6.0
Therapeutic radiology	660	830	1,060	0.3	0.3	0.3
Miscellaneous	32,770	27,580	21,830	12.8	8.5	5.2

[1] Excludes 1,580 diplomates in family practice who have been shown separately.
[2] Includes pediatric allergy and pediatric cardiology.

Source: 1970 physicians: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.
1970 diplomates in family practice: *Directory of Approved Internships and Residencies, 1971-72.* Chicago, American Medical Association 1971.

Note: Figures may not add to totals and subtotals due to independent rounding.

among FMG's, there will be an increase in the proportion of U.S. and Canadian physicians, from 6 percent of their total numbers in 1970 to 9 percent in 1990.

Another way of assessing the projections of specialists is through an examination of the M.D./population ratios implied by the projections. In Table 38, it can be seen that the overall M.D./population ratio is projected to increase from 153 per 100,000 population in 1970 to 190 per 100,000 in 1980 and to 228 per 100,000 in 1990. The foreign medical graduate component is projected to increase at a more rapid pace than either U.S. or Canadian graduates. These relative differences have implications for many of the specialties.

In general practice, the ratio of M.D.'s to population is projected to decline from 28 per 100,000 in 1970 to 15 per 100,000 in 1990. The decline is projected to be much more dramatic among U.S. and Canadian physicians, however, with the ratio decreasing from 24 U.S.-Canadian M.D.'s per 100,000 population in 1970 to only 12 per 100,000 in 1990. Partially offsetting the impact of the decline in

Table 38.

RATIOS OF ACTIVE PHYSICIANS (M.D.) TO POPULATION, BY SPECIALTY AND COUNTRY OF GRADUATION: ACTUAL 1970; PROJECTED 1980 AND 1990

Specialty	Active physicians (M.D.) per 100,000 population[1]								
	Total physicians			U.S. and Canadian trained physicians			Foreign trained physicians		
	1970	1980	1990	1970	1980	1990	1970	1980	1990
Total active physicians	152.7	189.6	227.8	126.0	143.6	166.2	26.7	46.0	61.6
General practice	27.6	20.8	14.6	24.4	17.8	11.9	3.3	3.0	2.8
Medical specialties	32.6	48.8	65.1	27.3	36.9	47.6	5.2	11.9	17.5
Dermatology	2.0	2.5	3.1	1.8	2.3	2.9	0.2	0.2	0.2
Family practice	0.8	1.3	1.8	0.8	1.2	1.6	0.1	0.1	0.2
Internal medicine	20.5	31.3	42.1	17.4	24.0	31.3	3.1	7.3	10.8
Pediatrics[2]	9.2	13.7	18.1	7.4	9.4	11.8	1.9	4.3	6.3
Surgical specialties	41.9	58.8	76.2	35.8	45.8	57.4	6.1	13.1	18.8
General surgery	14.6	24.2	33.7	12.0	17.4	23.3	2.6	6.9	10.4
Neurological surgery	1.3	1.7	2.1	1.1	1.3	1.6	0.2	0.3	0.5
Obstetrics and gynecology	9.3	11.4	13.6	7.8	8.4	9.3	1.5	3.0	4.2
Ophthalmology	4.9	5.9	7.2	4.5	5.5	6.7	0.4	0.5	0.5
Orthopedic surgery	4.7	6.2	7.8	4.3	5.6	7.0	0.4	0.6	0.8
Otolarynogology	2.7	3.2	3.7	2.3	2.8	3.3	0.3	0.4	0.5
Plastic surgery	0.8	1.2	1.6	0.7	1.0	1.3	0.1	0.2	0.3
Thoracic surgery	0.9	1.3	1.8	0.7	0.9	1.2	0.2	0.4	0.6
Urology	2.8	3.7	4.7	2.5	3.0	3.6	0.4	0.7	1.1
Other specialties	50.6	61.1	71.9	38.5	43.1	49.3	12.1	18.0	22.6
Anesthesiology	5.4	7.7	10.0	3.7	4.4	5.3	1.6	3.3	4.7
Child psychiatry	1.0	1.7	2.4	0.8	1.3	1.8	0.2	0.4	0.6
Neurology	1.5	2.6	3.7	1.2	2.0	2.8	0.3	0.7	1.0
Psychiatry	10.4	15.0	19.7	7.9	11.1	14.8	2.5	3.9	5.0
Pathology	5.0	7.8	10.4	3.5	4.2	5.1	1.5	3.6	5.4
Physical medicine and rehabilitation	0.7	1.1	1.4	0.5	0.5	0.6	0.2	0.6	0.9
Radiology	5.2	8.6	12.1	4.5	7.1	9.9	0.7	1.5	2.2
Therapeutic radiology	0.4	0.5	0.6	0.3	0.4	0.4	0.1	0.1	0.2
Miscellaneous	21.0	16.1	11.6	16.1	12.2	8.7	5.0	3.9	2.9

[1] Resident population as of July 1.
[2] Includes pediatric allergy and pediatric cardiology.

Source: U.S. and Canadian trained physicians: Table 37.
Foreign trained physicians: Table 36.
Population: Bureau of the Census. *Current Population Reports*, Series P-25, Nos. 468, 477, and 483.

Note: Figures may not add to totals and subtotals due to independent rounding.

general practice, however, are the aforementioned projected increases in the related primary care specialties of internal medicine and pediatrics.

The surgical specialties are projected to increase their M.D./population ratio substantially, rising from 42 per 100,000 in 1970 to 76 per 100,000 in 1990. The increase among U.S. and Canadian graduates, however, is projected to be proportionally less than among FMG's. The U.S.-Canadian M.D./population ratio in surgery is projected to rise from 36 to 57 per 100,000; while the FMG ratio is projected to rise from 6 to 19 per 100,000. Similarly, the increase in the FMG/population ratio in the other specialties is projected to be proportionally greater than that for the U.S.-Canadian graduates. However, it is important to note that in nearly every specialty field (with the exception of general practice, physical medicine and rehabilitation, and anesthesiology) the 1990 population ratio of U.S. M.D.'s alone is projected to exceed or equal the ratio for *all* physicians (including Canadian graduates and FMG's) that prevailed in 1970.

The anticipated specialty increases among U.S. medical school graduates over the next 20 years may have a major impact on residency training of FMG's. By 1990, the U.S. graduating class is projected to be nearly 7,000 larger than it is today, and with this rise in the number of U.S. graduates seeking residency training, substantial pressure will be extended on residency positions in the future. The possible impact of increased numbers is partially obscured by the reservoir of unfilled first-year residency positions reported each year. For example, in 1970, first-year residency positions were filled by 10,199 U.S. and Canadian graduates and 4,357 foreign trained graduates, leaving 2,350 positions vacant. The projected 7,000 increase in U.S. graduates alone will more than fill those vacant positions, not to mention the projected 5,200 annual increase of FMG's. There is also substantial variation among the specialties in the proportion of unfilled positions. For example, in 1971 there were 690 unfilled first-year residency positions in pathology and psychiatry, but only 1 unfilled position in dermatology.

It is difficult to foresee how the increased U.S. graduate demand for residency positions will affect the flow of FMG's. Increased competition among U.S. trained physicians for training appointments may mean that the pool of U.S. graduates who do not obtain their first choice of training position will increase, thereby making it necessary for many to move into the less popular residency programs—those now often filled by FMG's. In addition, a dropping of the free-standing internship, coupled with a possible tightening of requirements for approval of residency training programs, might reduce substantially the number of available approved training programs.

Another new development which may have a significant effect on graduate medical education in the future is the increasing demand, particularly on the part of female physicians, for part-time residencies. Until recently, only the specialty of psychiatry provided for this, but an increasing number of training programs in other specialties are now willing to consider it on an individual basis. Altogether, these trends may alter substantially the residency situation and hence the specialty distribution of the physician population.

ALTERNATIVE PROJECTIONS

The second approach utilized to project specialty distributions was quite similar to the basic methodology except for the fact that a distribution of total, rather than first-year, residencies was used to project specialty choices of future graduates from medical schools. The primary merit of this methodology over the basic approach is the fact that it reduces the double-counting problem that occurs particularly in the surgical specialties. The primary disadvantage of this methodology lies in the implicit assumption that all residents in any 5-year cohort will have completed their training by the onset of the second 5-year cohort, when in fact many may still be in training, since periods of residency training vary from 1 to 5 years. Another disadvantage of this methodology is the fact that it reflects the "less recent" experience of residency preferences among medical school graduates. That is, it reflects the choices of 1965-70 graduates, whereas the basic methodology primarily reflects the preferences of 1970 graduates.

Another alternative methodology employed to project the number of physicians by medical specialty was based largely upon the extrapolation of trends in the specialty distributions of first-year residents. The trend data examined consisted of the total number of first-year residents by specialty as of Sept. 1, 1961, 1962, 1967, 1968, 1970, and 1971[11] (the only years for which published data were available). Given the marked fluctuations in these time intervals, trend data were not computable for three specialty classifications—obstetrics and gynecology, pathology, and miscellaneous. In these instances, the extrapolations were done somewhat arbitrarily, given the data available. The extrapolated projections for family practice were based on the 1970 and 1971 data.

The advantage of this methodology over the previous two projections is that it is not based on the perhaps unrealistic assumption that the residency distribution by specialty will remain constant from 1970 through 1990. Historical trend data substantiate the fact that there are varying growth rates among the specialties, although these are minor differences for the most part. The primary disadvantage of this methodology is the lack of sufficient trend data, both in terms of previous years' experiences of residents and the specialty distribution patterns of U.S.-trained M.D.'s and FMG's. Hence, for example, this methodology is not able to disaggregate its projected numbers by country of education. Nonetheless, given an assumption that these trends may be more reflective of the future developments, this approach also provided useful insights into projected specialty patterns.

As can be seen in Tables 39 and 40, the three separate methodologies project remarkably similar numbers for each group of specialties. This reflects in part, the fact that the three methodologies treat only graduate input differently; the future specialty distribution of those M.D.'s active in 1970 remains the same under each method. Some differ-

[11] American Medical Association, *Directory of Approved Internships and Residencies, 1972-73.* Chicago, The Association, 1972. Also earlier issues.

Table 39.

COMPARISON OF TWO ALTERNATIVE SPECIALTY PROJECTIONS OF PHYSICIANS (M.D.) WITH THE BASIC METHODOLOGY PROJECTIONS: 1980 AND 1990

Specialty	1980			1990		
	Basic	I	II	Basic	I	II
All active physicians (M.D.)	430,240	430,240	430,240	571,030	571,030	571,030
General practice	47,210	46,580	46,940	36,700	35,380	34,490
Medical specialties	110,750	103,040	110,910	163,240	146,140	163,600
Dermatology	5,660	5,960	5,760	7,750	8,300	7,970
Family practice	2,920	2,560	5,150	4,450	3,660	11,050
Internal medicine	71,020	66,520	69,130	105,620	95,510	99,580
Pediatrics[1]	31,140	28,000	30,870	45,410	38,590	45,000
Surgical specialties	133,550	139,910	131,390	190,870	204,840	181,390
General surgery	55,010	53,780	52,870	84,580	81,800	76,070
Neurological surgery	3,800	4,710	3,600	5,260	7,280	4,770
Obstetrics and gynecology	25,850	27,320	26,440	33,970	37,130	37,360
Ophthalmology	13,450	14,210	13,550	17,930	19,590	15,350
Orthopedic surgery	14,050	16,950	13,760	19,580	26,020	18,760
Otolaryngology	7,170	8,510	7,130	9,360	12,350	9,350
Plastic surgery	2,740	2,470	2,740	4,120	3,510	4,400
Thoracic surgery	3,010	2,700	3,120	4,400	3,730	4,520
Urology	8,460	9,280	8,190	11,660	13,440	10,810
Other specialties	138,720	140,650	141,130	180,210	184,620	191,870
Anesthesiology	17,510	16,470	17,310	24,960	22,770	24,420
Child psychiatry	3,860	3,640	4,190	5,970	5,490	7,300
Neurology	5,940	6,030	6,240	9,350	9,560	10,380
Psychiatry	34,070	34,800	33,020	49,480	51,050	45,390
Pathology	17,800	18,960	17,100	26,150	28,730	24,150
Physical medicine and rehabilitation	2,500	2,610	2,620	3,610	3,860	4,040
Radiology	19,430	20,370	[2] 20,350	30,210	32,300	[2] 31,640
Therapeutic radiology	1,130	1,160	–	1,440	1,510	–
Miscellaneous	36,460	36,620	40,320	29,020	29,370	44,560

[1] Includes pediatric allergy and pediatric cardiology.
[2] Includes therapeutic radiology.

Source: Basic: Based on distribution of first-year residencies.
I: Based on distribution of total residencies.
II: Based on extrapolation of the trends in first-year residencies.

Note: Figures may not add to totals and subtotals due to independent rounding.

ences appear by 1990, however, particularly among family practice and the surgical specialties, with the numbers for family practice evidencing the greatest variation. This variation is most probably due to the fact that its annual growth rate is among the highest of the specialties, particularly in their most recent experience. It is also interesting to note the variation that occurs among the different projections for the surgical specialties. The numbers for general surgery projected in the alternative methodologies show reduced numbers of general surgeons vis-a-vis the other surgical specialties, thus minimizing the double-counting problem that occurs in the basic methodology.

The estimates for the miscellaneous specialists projected by trend data should be viewed with particular caution. These figures were based on very rough estimations derived from data that exhibited considerable fluctuation from year to year (as was the case, although to a lesser degree, for obstetrics-gynecology and pathology).

Table 40.

PERCENT DISTRIBUTION OF TWO ALTERNATIVE SPECIALTY PROJECTIONS OF PHYSICIANS (M.D.) WITH THE BASIC METHODOLOGY PROJECTIONS: 1980 AND 1990

Specialty	1980			1990		
	Basic	I	II	Basic	I	II
All active physicians (M.D.)	100.0	100.0	100.0	100.0	100.0	100.0
General practice	11.0	10.8	10.9	6.4	6.2	6.0
Medical specialties	25.7	24.0	25.8	28.6	25.6	28.7
Dermatology	1.3	1.4	1.3	1.4	1.5	1.4
Family practice	0.7	0.6	1.2	0.8	0.6	1.9
Internal medicine	16.5	15.5	16.1	18.5	16.7	17.4
Pediatrics[1]	7.2	6.5	7.2	8.0	6.8	7.9
Surgical specialties	31.0	32.5	30.5	33.4	35.9	31.8
General surgery	12.8	12.5	12.3	14.8	14.3	13.3
Neurological surgery	0.9	1.1	0.8	0.9	1.3	0.8
Obstetrics and gynecology	6.0	6.4	6.2	5.9	6.5	6.5
Ophthalmology	3.1	3.3	3.2	3.1	3.4	2.7
Orthopedic surgery	3.3	3.9	3.2	3.4	4.6	3.3
Otolaryngology	1.7	2.0	1.7	1.6	2.2	1.6
Plastic surgery	0.6	0.6	0.6	0.7	0.6	0.8
Thoracic surgery	0.7	0.6	0.7	0.8	0.7	0.8
Urology	2.0	2.2	1.9	2.0	2.4	1.9
Other specialties	32.2	32.7	32.9	31.6	32.3	33.6
Anesthesiology	4.1	3.8	4.0	4.4	4.0	4.3
Child psychiatry	0.9	0.9	1.0	1.0	1.0	1.3
Neurology	1.4	1.4	1.5	1.6	1.7	1.8
Psychiatry	7.9	8.1	7.7	8.7	8.9	8.0
Pathology	4.1	4.4	4.0	4.6	5.0	4.2
Physical medicine and rehabilitation	0.6	0.6	0.6	0.6	0.7	0.7
Radiology	4.5	4.7	[2] 4.7	5.3	5.7	[2] 5.5
Therapeutic radiology	0.3	0.3	–	0.3	0.3	–
Miscellaneous	8.5	8.5	9.5	5.1	5.1	7.8

[1] Includes pediatric allergy and pediatric cardiology.
[2] Includes therapeutic radiology.

Source: Table 39.

Note: Figures may not add to totals and subtotals due to independent rounding.

REVISED SUPPLY PROJECTIONS

The projections of specialty distribution shown above utilized 1970 residency data as the basis for all three of the alternate approaches. In the first two series, 1970 first-year residency patterns and 1970 total residency patterns, respectively, were used as proxies for future career choices of new entrants to the profession. For the third series residency trend data through 1970 were used. Projections developed by BHRD subsequent to the preparation of this report, apply the 1972 residency data as specialty choice indicators within the respective methodologies. For a group such as general practitioners, where residency numbers are virtually negligible, such a change in the methodology data base makes little difference in the final outcome. In contrast, for a specialty such as family practice, where residency growth has been especially rapid in recent years, the change of base year in the methodology brings recent developments into the analysis.

According to the supply projections developed under the revised basic series (i.e., using 1972 first-year residency patterns for estimating future career patterns), general practitioners are projected to continue their declining trend, falling from 56,300 in 1970 to 36,500 in 1990. (See Table 40a.) This largely reflects the fact that current residencies in this area are negligible and that the future

Table 40a.

SUPPLY OF ACTIVE PHYSICIANS (M.D.), BY SPECIALTY: ACTUAL 1970; PROJECTED 1980 AND 1990

Specialty	Number of physicians (M.D.)			Percent distribution		
	1970	1980	1990	1970	1980	1990
Total active physicians	311,210	430,240	571,030	100.0	100.0	100.0
General practice	[1] 56,260	47,140	36,510	18.1	11.0	6.4
Medical specialties	66,380	116,010	174,960	21.3	27.0	30.6
Dermatology	4,000	5,610	7,620	1.3	1.3	1.3
Family practice	1.690	6,610	12,630	0.5	1.5	2.2
Internal medicine	41,870	71,650	106,8	13.5	16.7	18.7
Pediatrics[2]	18,820	32,150	47,830	6.0	7.5	8.4
Surgical specialties	85,380	128,970	180,810	27.4	30.0	31.7
General surgery	29,760	52,450	78,890	9.6	12.2	13.8
Neurological surgery	2,580	3,440	4,500	0.8	0.8	0.8
Obstetrics and gynecology	18,880	26,110	34,590	6.1	6.1	6.1
Ophthalmology	9,930	12,920	16,730	3.2	3.0	2.9
Orthopedic surgery	9,620	13,350	18,030	3.1	3.1	3.2
Otolaryngology	5,410	6,800	8,520	1.7	1.6	1.5
Plastic surgery	1,600	2,860	4,360	0.5	0.7	0.8
Thoracic surgery	1,810	3,020	4,430	0.6	0.7	0.8
Urology	5,800	8,030	10,740	1.9	1.9	1.9
Other specialties	103,190	138,120	178,760	33.2	32.1	31.3
Anesthesiology	10,860	17,360	24,560	3.5	4.0	4.3
Child psychiatry	2,100	4,270	6,870	0.7	1.0	1.2
Neurology	3,070	6,500	10,580	1.0	1.5	1.9
Psychiatry	21,150	32,780	46,550	6.8	7.6	8.2
Pathology	10,280	16,770	24,000	3.3	3.9	4.2
Physical medicine	1,480	2,550	3,720	0.5	0.6	0.7
Radiology	10,520	14,740	19,730	3.4	3.4	3.5
Therapeutic radiology	870	1,760	2,790	0.3	0.4	0.5
Miscellaneous	42,860	41,400	39,960	13.8	9.6	7.0

[1] Excludes 1,690 diplomates in family practice who have been shown separately.
[2] Includes pediatric allergy and pediatric cardiology.

Source: Projections developed by RAS, BHRD, HRA, (April, 1974). These projections update earlier projections for medical specialties developed by RAS. See text of this report for explanation.

Note: Figures may not add to totals and subtotals due to independent rounding.

supply will be almost completely determined by survivors of those practicing now. Among the remaining specialty areas, in contrast, all are projected to increase over the coming years, but at differing rates of growth.

The primary care specialties (general practice, family practice, internal medicine, pediatrics, and obstetrics/gynecology) as a group are now projected under the basic series to increase from 137,500 in 1970 to 183,700 by 1980 and to 238,400 by 1990. Among individual components, the most rapid growth rate is projected for the recently recognized specialty of family practice (from 1,690 in 1970 to 12,630 by 1990, or an increase of 647 percent). The numbers of physicians in both internal medicine and in pediatrics are projected to increase substantially over the 1980 and 1990 period. As a result of these increases among individual specialties, the projected decline in general practice will be partially offset. Nonetheless, the proportion of all physicians that are in primary care activities is projected to edge down over the projection period, from 44 percent in 1970 to 42 percent by 1990.

The results from all three projection series developed are shown in Table 40b. In all instances, as indicated earlier, the projections of individual specialties have been controlled to overall M.D. projections derived independently by RAS. For most specialties, the revised projection findings are roughly comparable when either first-year residency positions or extrapolated trend data on residencies are considered (i.e., the basic series and series II).

Table 40b.

COMPARISON OF TWO ALTERNATIVE SPECIALTY PROJECTIONS OF PHYSICIANS (M.D.) WITH THE BASIC METHODOLOGY PROJECTIONS: 1980 AND 1990

Specialty	1980			1990		
	Basic	I	II	Basic	I	II
All active physicians (M.D.)	430,240	430,240	430,240	571,030	571,030	571,030
General practice	47,140	46,460	45,990	36,510	35,090	33,460
Medical specialties	116,010	107,280	121,500	174,960	155,580	195,860
Dermatology	5,610	5,800	5,770	7,620	8,050	7,880
Family practice	6,610	5,480	15,320	12,630	10,120	42,710
Internal medicine	71,650	66,840	69,350	106,880	96,160	100,040
Pediatrics[1]	32,150	29,170	31,060	47,830	41,250	45,230
Surgical specialties	128,970	135,660	125,800	180,810	195,550	167,310
General surgery	52,450	51,300	50,600	78,890	76,420	71,440
Neurological surgery	3,440	4,500	3,400	4,500	6,830	4,340
Obstetrics and gynecology	26,110	27,230	23,920	34,590	36,950	27,920
Ophthalmology	12,920	13,820	13,290	16,730	18,720	17,020
Orthopedic surgery	13,350	16,500	13,600	18,030	25,010	18,220
Otolaryngology	6,800	8,220	6,930	8,520	11,670	8,790
Plastic surgery	2,860	2,530	2,930	4,360	3,650	4,680
Thoracic surgery	3,020	2,600	3,060	4,430	3,530	4,340
Urology	8,030	8,960	8,090	10,740	12,780	10,560
Other specialties	138,120	140,840	137,000	178,760	184,810	174,490
Anesthesiology	17,360	16,660	17,040	24,560	23,090	23,760
Child psychiatry	4,270	3,730	4,600	6,870	5,670	7,940
Neurology	6,500	6,240	6,580	10,580	10,000	10,910
Psychiatry	32,780	33,600	31,970	46,550	48,410	43,170
Pathology	16,770	18,610	15,880	24,000	27,910	21,130
Physical medicine and rehabilitation	2,550	2,580	2,670	3,720	3,800	4,110
Radiology	14,740	15,670	18,970	[2] 19,730	21,830	[2] 27,580
Therapeutic radiology	1,760	1,850	–	2,790	3,000	–
Miscellaneous	41,400	41,910	39,280	39,960	41,110	35,860

[1] Includes pediatric allergy and pediatric cardiology.
[2] Includes therapeutic radiology.

Source: Projections developed by RAS, BHRD, HRA (April 1974). These projections update earlier projections for medical specialties shown in Table 39.

Basic: Based on distribution of first-year residencies.

I. Based on distribution of total residencies.

II: Based on extrapolation of the trends in first-year residencies.

Note: Figures may not add to totals and subtotals due to independent rounding.

This reflects the fact that, in general, the first-year residency patterns, reflecting recent developments, are more consistent with trend expectations than are total residency patterns. Among the individual specialty groups considered for this analysis, the most notable exception to this generalization is family practice.

Previous discussions have noted the exceptionally rapid growth in family medicine residency positions in recent years. The use of trend data for projection purposes (Series II), consequently, results in exceptionally high supply estimates for the projection period, particularly by 1990. As shown in Table 40b, for that matter, a trend extrapolation for this specialty results in a 1980 supply estimate (15,320) that is 20 to 50 percent above that estimated for 1990 by the other two projection series. A continuation of the recent pace of residency growth in family practice uninterrupted over the next two decades, however, seems somewhat questionable and, therefore, the supply projections developed in this manner should be viewed with particular caution.

Chapter 5 • DENTISTS

The basic sources of information on dentists are publications of the American Dental Association (ADA)[1] and preliminary results from the Second National Survey of Licensed Dentists, 1967-70, conducted by the Division of Dental Health in the Bureau of Health Resources Development (BHRD). Data cover all civilian dentists located in the 50 States and the District of Columbia. In addition, dentists in the Armed Forces both in the United States and abroad are included in the statistics shown, unless indicated otherwise.

It should be noted at the outset that data on active dentists presented in this report are estimates based essentially on the ratio of active to total dentists derived from data in the 1950 Census of Population and the number of graduates from U.S. dental schools less separations. Since virtually all dentists practicing in the United States have graduated from dental schools located in this country and since losses of U.S. graduates through migration to foreign locations are negligible, the active dentist supply represents the net balance between the total number ever graduated from American schools and the number lost through deaths and retirement.

The numbers of deaths each year were estimated from death rates for white males only, given the very small proportion of women dentists and Black dentists in the profession. Since death rates for women are lower than for men and higher for Blacks than for whites, the net error incurred is believed to be very small. The basic data on deaths were drawn from life tables issued by the National Center for Health Statistics.[2]

In order to estimate dentist deaths from these tables, an average age was assigned to each dental graduating class.[3] According to the ADA, the median age at graduation was 25 years prior to World War II, 28 years in the period 1950-54, and currently 26 years. Using these figures, an estimate was obtained of the total number of dental graduates surviving to any given year, including 1970. To derive estimates of active dentists, conversion ratios of active dentists to total dentists based on data from the 1950 Census of Population were used.

These conversion ratios were derived by comparing the number of dentists included in the 1950 census counts for each 5-year age interval with the total number of living dentists in that age interval. The resulting values were then plotted and a smooth curve created with approximate values interpolated for each 5-year interval of age.[4] These "percentage active" values were then applied to the relevant age group of dentists in all graduating classes. Using these ratios, a historical series of active dentists was developed through December 31, 1970.

At present, the Register of Licensed Dental Manpower contains 48 States and the District of Columbia. When active rates for 1968-69 from the Division of Dental Health's Second National Survey of Licensed Dentists are applied to the number of licensed in-State dentists in the Annual Register, the number of active dentists is less than 1 percent greater than the number of active dentists as projected in this report as of the end of 1971. The same comparisons by State showed less than 10 percent difference in most States, with the noticeable exceptions of the District of Columbia (38 percent) and the State of Washington (25 percent). These figures, consequently, tend to reinforce most of the projected methodology used in this chapter.

In order to provide an improved and current data base, the Division of Dental Health is establishing a Biennial Register of Licensed Dental Manpower under contract with the American Association of Dental Examiners. With the cooperation of the 51 Boards of Dentistry, the first annual register will include the name, address, and license number of all dentists and hygienists licensed by the 50 States and the District of Columbia as of August 1971. Future registers of dentists will also include year of birth, school of graduation, and year of graduation. Both the dentist and hygienist registers will be updated each year through the American Association of Dental Examiners and the 51 Boards of Dentistry.

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[1] *Annual Report on Dental Education, 1972-73.* Chicago, American Dental Association, 1973. Also prior annual issues.

[2] National Center for Health Statistics. *Vital Statistics of the United States, 1967.* Vol. II Section 5. Life Tables. Rockville, Maryland, Health Services and Mental Health Administration, 1970.

[3] Once each class had been assigned an average age, it was then possible to use the life tables to estimate the number of deaths. Life tables for 1901-09 were used for the period 1900 to 1925, tables for 1928-31 for years 1925 to 1935, tables for 1937-41 for the years 1935 to 1945, tables for 1949-51 for the years 1945 to 1955, tables for 1959-61 for the years 1955 to 1965, and the table for 1967 for the years 1965 to 1990.

[4] By age group, the "percentage active" figures were as follows: under 44 years—100 percent; 45-49 years—98 percent; 50-54 years—91 percent; 55-59 years—83 percent; 60-64 years—75 percent; 65-69 years—66 percent; 70-74 years—57 percent; 75-79 years—47 percent; 80-84 years—35 percent; 85-89 years—22 percent; and 90 years and over—10 percent.

CURRENT CHARACTERISTICS AND TRENDS

The Division of Dental Health estimates that there were approximately 102,220 active dentists in the U.S. in 1970.[5] Of these, 95,680 were civilian dentists located in the 50 States and Washington, D.C., and 6,540 were dentists in the Armed Forces.

Active dentists are a relatively young group. In 1970, the median age was estimated to be 43 years, with approximately 30 percent of the active supply less than 35. At the other end of the age spectrum, slightly more than 10 percent, or 11,420 active dentists, were estimated to be 65 years old or over. (See Table 41.)

[5] This estimate of active dentists is essentially the same as that listed for dentists under 68 years of age (102,500 in 1970) in: American Dental Association. *American Dental Directory, 1972.* Chicago, The Association, 1972.

Table 41.

NUMBER OF ACTIVE DENTISTS, BY SEX AND BY AGE GROUP: DECEMBER 31, 1970

Sex and age group	Number of active dentists	Percent distribution
Both sexes	102,220	100.0
Male	98,950	96.8
Female	3,270	3.2
All ages	102,220	100.0
Less than 25 years	2,500	2.4
25-44 years	53,000	51.8
25-29	11,580	11.3
30-34	15,590	15.2
35-39	13,560	13.3
40-44	12,270	12.0
45-64	35,300	34.6
45-49	14,530	14.2
50-54	9,370	9.2
55-59	5,910	5.8
60-64	5,490	5.4
65 years and over	11,420	11.2
65-69	5,100	5.0
70-74	3,400	3.3
75 and over	2,920	2.9

Source: Estimates by sex: Sex distribution of active dentists from 1970 Census of Population was applied to the estimated number of active dentists.

Estimates by age: Percentage active factors were applied to the total number of living dentists at each year of age.

According to information from the 1970 Census of Population, there are very few females in the dental profession—only about 3 out of every 100 civilian dentists in 1970.[6] Although current information is relatively sketchy, a recent report published by the American Dental Association suggests that the number of female dental students and dentists will probably rise in the coming years.[7] This prediction is based largely on the fact that in academic year 1971-72, over 40 percent of the women enrolled in dental schools were first-year students, and they constituted 2 percent of freshman enrollment.

Blacks also make up only a small part of the dental work force. According to data from the 1970 Census, Blacks accounted for only 2.3 percent of the civilian dentists in 1970, about the same as in 1960. This proportion is expected to rise, however, as the result of recent increases in enrollment of Blacks in dental schools. Between the 1963-64 and 1971-72 academic years, for example, first-year enrollment of Blacks rose from 2.3 percent of total first-year enrollment to 5.0 percent. In current first-year enrollment, Blacks account for 4.6 percent, Orientals for 2.6 percent, Spanish- or Mexican-Americans for 1.1 percent, and American Indians for about 0.1 percent.

Almost all active dentists (97 percent) in 1970 were primarily engaged in providing direct patient care, as shown in Table 42. Two percent of the total, or 1,900 active dentists, were engaged principally in teaching, with the remaining few in research and administrative activities.

[6] U.S. Bureau of the Census. *United States Census of Population: 1970. Detailed Characteristics. United States Summary.* PC(1)-D1. U.S. Government Printing Office, 1973.

[7] *Annual Report on Dental Education, op. cit.*

Table 42.

NUMBER OF ACTIVE CIVILIAN DENTISTS, BY MAJOR PROFESSIONAL ACTIVITY: DECEMBER 31, 1970

Major professional activity	Number of active civilian dentists	Percent distribution
All activities	95,680	100.0
Care	92,380	96.6
Administration	1,100	1.1
Teaching	1,900	2.0
Research and other	300	0.3

Source: BHRD, Division of Dental Health based on data from 1965-66 survey of licensed dentists and other sources.

Between 1950 and 1971, the number of active dentists is estimated to have grown from 79,190 to 103,750, an increase of nearly 31 percent. There was relatively little difference in the growth patterns of the 1950's or the 1960's. (See Table 43.) Despite the increase in the number of dentists during the 1950's, the ratio of active dentists to population declined slightly between 1950 and 1960. Although the downward trend in the ratios leveled off after 1960, the 1971 ratio was still below that of 1950. In 1950, there were 52 active dentists per 100,000 civilians; in 1971, the ratio was 50 per 100,000. (See Table 43.)

As indicated earlier, the supply of active dentists in the United States consists almost completely of Americans who have graduated from U.S. dental schools. In 1970, 0.7 percent of active dentists were graduates of foreign dental schools. Canadian schools furnished two-thirds of all foreign graduates.[8]

The distribution of active civilian dentists varied widely in 1970 among States, ranging from a high of 69 per 100,000 civilian resident population in New York State to a low of 25 per 100,000 in South Carolina. In general, States in the Northeast and West had higher dentist-to-population ratios than the national average (47 per 100,000), while those in the North Central and South had lower ratios. (See Table 44.) For States with ratios greater than the national average, two of every three had a dental school; for States below the national average, in contrast, the proportion was two of five.

As might be expected, self-employment predominates among dentists who are active in the profession—about 88,000 (86 percent) were engaged primarily in private practice. Of the remaining number, 2.1 percent were teaching at schools of dentistry, 1.5 percent were State or local government employees, and 7.8 percent were employed by the Federal Government. (See Table 45.)

In 1971, some 10,700 dentists were recognized by the American Dental Association as specialists in one of eight areas of dentistry. Over two-fifths, or about 4,420 of the specialists, limited their practice exclusively to orthodontics. The next largest group, 2,570 specialized in oral surgery, followed by 1,200 in pedodontics and 1,040 in periodontics. Relatively few specialists engaged in one of the other recognized areas—prosthodontics, endodontics, public health dentistry, and oral pathology. (See Table 46.)

Dental specialists were about equally distributed among the four geographic regions, with the West having the highest specialist-to-dentist ratio. The West had 12.5 specialists per 100 dentists, followed by the South with 10.7, the North Central 9.4, and the Northeast 9.4. Among individual States, specialist/dentist ratios ranged from a high of approximately 14.2 specialists per 100 dentists in California to a low of 3.9 per 100 in Mississippi.

[8] Derived from data in: American Dental Association. *American Dental Directory, 1972.* Chicago, The Association, 1972.

Table 43.

TREND IN NUMBER OF ACTIVE DENTISTS AND DENTIST/POPULATION RATIOS: SELECTED YEARS DECEMBER 31, 1950-71

Year	Number of active dentists	Population[1] (in 1,000's)	Active dentists per 100,000 population
1950	79,190	153,622	51.5
1955	84,370	167,513	50.4
1960	90,120	182,275	49.4
1961	91,390	185,214	49.3
1962	92,730	187,974	49.3
1963	93,750	190,618	49.2
1964	94,900	193,162	49.1
1965	95,990	195,468	49.1
1966	97,050	197,656	49.1
1967	98,320	199,721	49.2
1968	99,480	201,678	49.3
1969	100,720	203,777	49.4
1970	102,220	206,017	49.6
1971	103,750	208,056	49.9

[1] Total population including Armed Forces overseas.

Source: Active dentists: BHRD, Division of Dental Health.
Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, Nos. 465 and 475.

PROJECTIONS OF THE SUPPLY OF DENTISTS TO 1990

Projections of the supply of active dentists are presented here along with a discussion of how these projections were developed. The first part of the discussion relates to the basic methodology utilized to project the overall supply of active dentists. Additional information is also provided on the impact on the projections of different assumptions as to graduate input.

METHODOLOGY AND ASSUMPTIONS

Projections of the number of active dentists for the 1971-90 period were calculated using essentially the same methodology described earlier for estimating active dentists in 1970 and earlier years. Data on 1971 graduates of dental schools were obtained from school reports on 1972 capitation grant applications; these applications also provided estimates of first-year enrollments through 1974-75.

Table 44.

NUMBER OF ACTIVE CIVILIAN DENTISTS AND DENTIST/POPULATION RATIOS, BY GEOGRAPHIC REGION, DIVISION, AND STATE: DECEMBER 31, 1970

Region, division, and State	Number of active civilian dentists	Civilian population July 1, 1970 (in 1,000's)	Rate per 100,000 population
UNITED STATES	95,680	201,717	47.4
NORTHEAST	28,820	48,945	58.9
New England	6,120	11,782	51.9
Connecticut	1,850	3,024	61.0
Maine	360	984	36.2
Massachusetts	3,000	5,674	52.9
New Hampshire	310	738	41.5
Rhode Island	430	916	46.9
Vermont	170	447	38.5
Middle Atlantic	22,700	37,164	61.1
New Jersey	4,090	7,134	57.3
New York	12,520	18,229	68.9
Pennsylvania	6,090	11,801	51.6
SOUTH	21,850	61,962	35.3
South Atlantic	10,790	30,126	35.8
Delaware	210	544	38.6
District of Columbia	650	736	88.3
Florida	2,570	6,743	38.2
Georgia	1,330	4,521	29.4
Maryland	1,560	3,869	40.3
North Carolina	1,480	4,974	29.8
South Carolina	640	2,522	25.4
Virginia	1,760	4,470	39.4
West Virginia	590	1,746	34.0
East South Central	4,140	12,703	32.6
Alabama	1,000	3,419	29.4
Kentucky	1,120	3,182	35.2
Mississippi	610	2,195	27.9
Tennessee	1,410	3,907	36.0
West South Central	6,920	19,134	36.2
Arkansas	600	1,918	31.4
Louisiana	1,250	3,602	34.8
Oklahoma	930	2,535	36.6
Texas	4,140	11,080	37.4
NORTH CENTRAL	26,190	56,529	46.3
East North Central	18,490	40,272	45.9
Illinois	5,540	11,085	50.0
Indiana	2,040	5,201	39.2
Michigan	4,280	8,886	48.1
Ohio	4,430	10,669	41.5
Wisconsin	2,200	4,431	49.6
West North Central	7,700	16,257	47.4
Iowa	1,320	2,829	46.7
Kansas	920	2,211	41.6
Minnesota	2,220	3,818	58.1

See footnotes at end of table.

Table 44.

NUMBER OF ACTIVE CIVILIAN DENTISTS AND DENTIST/POPULATION RATIOS, BY GEOGRAPHIC REGION, DIVISION, AND STATE: DECEMBER 31, 1970—Continued

Region, division, and State	Number of active civilian dentists	Civilian population July 1, 1970 (in 1,000's)	Rate per 100,000 population
NORTH CENTRAL—Continued			
West North Central—Continued			
Missouri	1,970	4,655	42.3
Nebraska	810	1,477	55.0
North Dakota	230	606	38.0
South Dakota	230	661	34.8
WEST	18,820	34,280	54.9
Mountain	3,740	8,224	45.5
Arizona	690	1,764	38.1
Colorado	1,130	2,176	51.9
Idaho	320	712	44.9
Montana	310	691	44.3
Nevada	200	483	41.4
New Mexico	360	1,001	36.4
Utah	580	1,065	54.8
Wyoming	150	331	46.2
Pacific	15,080	26,056	57.9
Alaska	80	274	28.1
California	11,270	19,623	57.4
Hawaii	460	720	63.8
Oregon	1,370	2,098	65.2
Washington	1,900	3,341	56.0

Source: Active dentists: BHRD, Division of Dental Health based on data from the Second National Survey of Licensed Dentists, 1967-70.
Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 468.

Note: Figures may not add to totals and subtotals due to independent rounding.

Graduate projections for the 1972-78 period were computed from the number of first-year students reported 4 years earlier, utilizing the attrition rates (for each school) that were in evidence during the 1965-69 period. In 1950, the average attrition rate in dental schools was 4 percent; the ratio climbed to 12 percent in 1960, then declined to 4 percent in 1971.[9] For losses to the profession resulting from deaths, survival rates for white males were used, as described earlier in the chapter.

As with most other health professions, the future supply of dentists largely reflects the growth of enrollments in dental schools. From the early 1950's through 1971, the number of graduates from U.S. dental schools rose at an average annual rate of approximately 1.8 percent. However, from 1953 to 1964, the annual rate of increase averaged only 1.2 percent. From 1965 through 1971, it averaged 3.1 percent.[10] The latter spurt in graduates results in large part from the impact of Federal support provided through basic improvement and special project grants. Between 1965 and 1971, dental school enrollment rose at an average annual rate of about 3.6 percent, as compared with 2.3 percent for the 1960-71 period. (See Table 47.) Students enrolled in dental schools rose from 13,580 in 1960 to 17,300 in 1971, an increase of 27 percent.

Construction provisions in the Health Professions Educational Assistance (HPEA) Act have had a noticeable impact in recent years. In the academic year 1960-61, a total of 47

[9] In 1973, however, the attrition rate was 6 percent.

[10] *Annual Report on Dental Education, 1971-72.* Chicago, American Dental Association, 1972.

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Table 45.

NUMBER OF ACTIVE DENTISTS, BY TYPE OF PRACTICE: DECEMBER 31, 1970

Type of practice	Number of active dentists	Percent distribution
All types of practice	102,220	100.0
Self employed	87,780	85.9
Individual practice	80,780	79.0
Partnership	6,000	5.9
Shareholder in incorporated practice	1,000	1.0
Other dentist or dental group	1,800	1.7
Dental school	2,100	2.1
State and local government	1,500	1.5
Federal Government	8,040	7.8
Armed Forces	6,540	6.4
Other	1,500	1.4
Other	1,000	1.0

Source: BHRD, Division of Dental Health based on data from various sources.

dental schools were in operation, and in 1963-64 there were 48. By the end of the decade, the number had risen to 53. One school closed in 1971. (See Table 47.) Four new schools opened in 1972-73, and two more in 1973-74, making a total of 58 schools in the current academic year.

For purposes of this report, the projections assumed that when the current legislation expires in FY 1974, there would be no extension of Federal legislative inducements to increase enrollments and the level of support from the public and private sectors combined would be sufficient only to maintain enrollment levels resulting from earlier Federal legislation. Given this framework, the basic methodology used to project future inputs of graduates maintained the total number of first-year students enrolled per year in the 1979-80 to 1986-87 period at the level reached in 1978-79. (See Table 48.)

Although this is a conservative approach, examination of historical information on enrollments and graduates suggests that it represents a reasonable assumption. As noted earlier, increases in dental enrollments prior to the HPEA period were very slight, at least during the years back to 1953. Even this slow growth resulted entirely from the opening of a number of new dental schools during these years, for combined enrollment in existing schools actually showed a slight decline.

Table 46.

TREND IN NUMBER OF ACTIVE DENTAL SPECIALISTS, BY SPECIALTY: 1952-71

Year[1]	All specialists	Endodontists[2]	Oral pathologists	Oral surgeons	Orthodontists	Pedodontists	Periodontists	Prosthodontists	Public health dentists
1952	2,584	–	13	684	1,251	86	366	173	11
1953	2,747	–	22	725	1,359	127	302	192	20
1954	2,843	–	24	779	1,443	141	220	212	24
1955	3,034	–	24	844	1,521	148	245	225	27
1956	3,098	–	29	843	1,637	151	194	214	30
1957	3,552	–	34	976	1,820	177	270	245	30
1958	3,787	–	37	1,089	1,925	184	283	239	30
1959	3,916	–	40	1,104	2,008	195	290	249	30
1960	4,170	–	42	1,183	2,097	229	307	278	34
1961	4,405	–	43	1,266	2,209	244	320	295	38
1962	5,121	–	41	1,338	2,818	257	328	296	43
1963	5,662	–	40	1,434	3,073	415	345	309	46
1964	5,985	–	45	1,502	3,261	447	361	317	52
1965	6,462	–	52	1,636	3,437	568	376	336	57
1968	9,705	439	89	2,262	4,128	1,106	929	654	98
1969	10,060	478	97	2,383	4,216	1,129	951	704	102
1970	10,315	497	97	2,406	4,335	1,159	1,003	715	103
1971	10,697	536	111	2,567	4,415	1,195	1,042	715	116

[1] Data not available for 1966 and 1967.
[2] Endodontics was not recognized as a dental specialty prior to 1965 and data are not available for 1965.

Source: Bureau of Economic Research and Statistics. *Facts About States for the Dentist Seeking a Location, 1970.* Chicago, American Dental Association. Also prior annual issues.

Table 47.

TREND IN NUMBER OF SCHOOLS, ENROLLMENTS, AND GRADUATES FOR DENTAL SCHOOLS: ACADEMIC YEARS 1960-61 THROUGH 1971-72

Academic year	Number of schools	Total enrollment	First-year enrollment	Graduates
1960-61	47	13,580	3,620	3,290
1961-62	47	13,510	3,600	3,210
1962-63	48	13,580	3,680	3,230
1963-64	48	13,690	3,770	3,210
1964-65	49	13,880	3,840	3,180
1965-66	49	14,020	3,810	3,200
1966-67	49	14,420	3,940	3,360
1967-68	50	14,960	4,200	3,460
1968-69	52	15,410	4,200	3,430
1969-70	53	16,010	4,360	3,750
1970-71	53	16,550	4,560	3,780
1971-72	52	17,300	4,740	3,960

Source: *Dental Students' Register, 1966-67.* Chicago, American Dental Association, 1967. Also prior annual editions.

Annual Report on Dental Education, 1972-73. Chicago, American Dental Association, 1973. Also prior annual editions.

Note: Data for University of Puerto Rico are included in this table.

A different assumption also was examined: that increases in enrollments after the expiration of the current legislation would occur at the same yearly rate as that experienced in the 10-year period prior to enactment of the HPEA Act. In view of the slow growth during this historical period (only about 1 percent annually), this alternative assumption would result in a supply estimate by 1990 less than 2 percent above that derived from the basic methodology. Because the difference between the two projections is so small, no detailed data for the second assumption are presented here.

A growing awareness of dental care needs in this Nation, along with continued Federal legislation, could conceivably motivate expansion in enrollments beyond that assumed and result in further increases in supply. However, it seems rather unlikely, on the basis of historical experience, that enrollment within existing schools would show a marked increase or that many new dental schools would come into being. With respect to this latter point, it should be noted that dental schools, unlike medical schools, must have their clinical work performed within the existing plant; in medical schools, in contrast, clinical work is generally undertaken outside of the school. This situation adds a considerable financial burden to the building of new dental schools. Furthermore, gifts, grants, endowment income, and income from regional organizations are of only nominal importance as income sources to dental schools—which means that these institutions must often seek public support for financing. During the HPEA period, for example, two private dental schools closed and five others had to ask States for support.

PROJECTION FINDINGS

The basic projection indicates that there will be a total gross graduate input of 101,690 over the 1971-90 period. If graduating classes were to grow at the same rate as during the decade before Federal spending, the graduate total would be 103,390—only 1,700 more graduates than the basic projection. However, if Federal support were to continue at the high levels of the late 1960's and early 1970's and the projected rate of increase in enrollments were to match the recent experience (a 6.5 percent average yearly rate of increase), a total gross graduate input of 123,580 would result for the 1971-90 period. (See Table 48.)

Under the basic methodology the number of dental schools graduating dentists is projected to increase from 53 in academic year 1970-71, to 54 as of 1974-75, and to 59 by 1975-76. This represents a net increase in the number of schools, as 10 new schools are assumed, along with the termination of one existing school. The total number of 59 schools is further assumed to remain constant through the remainder of the projection period.

Table 48.

FIRST-YEAR ENROLLMENTS AND GRADUATES IN DENTAL SCHOOLS USING BASIC METHODOLOGY: ACTUAL 1970-71 AND PROJECTED 1971-72 THROUGH 1989-90

Academic year	First-year enrollment	Graduates
1970-71	4,560	3,760
1971-72	4,710	3,920
1972-73	5,280	4,220
1973-74	5,380	4,570
1974-75	5,490	4,740
1975-76	5,540	5,060
1976-77	5,690	5,140
1977-78	5,830	5,210
1978-79	5,850	5,290
1979-80	5,850	5,370
1980-81	5,850	5,440
1981-82	5,850	5,440
1982-83	5,850	5,440
1983-84	5,850	5,440
1984-85	5,850	5,440
1985-86	5,850	5,440
1986-87	5,850	5,440
1987-88	–	5,440
1988-89	–	5,440
1989-90	–	5,440

Source: 1970-71 through 1974-75 first-year enrollments: Applications for capitation grants submitted to BHRD.

1970-71 graduates: Applications for capitation grants submitted to BHRD.

Note: Data for the University of Puerto Rico are excluded from this table.

As indicated earlier, the level of first-year enrollment is projected to level off by 1978-79 (graduates by 1981-82) and remain at that level through 1986-87 (graduates through 1989-90). These school projections result in an average of 92 graduates per school by 1980-81, compared to a 1970-71 average of 75 per school, and a projected ratio of 88 per school for 1974-75. This slowdown in graduates per school after 1974-75 appears consistent with the basic assumption explicit in the projection methodology.

Under the basic assumption, the supply of active dentists is projected to grow from 102,220 in 1970 to 126,170 in 1980 and to 154,910 in 1990. The increase in active dentists is thus projected at 23,950 between 1970 and 1980, nearly twice the increase of 12,100 from 1960 to 1970, or 23 percent as compared with 13 percent. Between 1980 and 1990, growth is projected to be about the same—a 28,740 increase (also 23 percent). The ratio of active dentists to population, which had edged up between 1960 and 1970, is projected to rise sharply in the future. The ratio is projected at 56 dentists per 100,000 population in 1980 and 62 per 100,000 in 1990; this compares with a ratio of 50 in 1970. (See Table 49.)

Table 49.

SUPPLY OF ACTIVE DENTISTS, USING BASIC METHODOLOGY: ACTUAL 1960 and 1970; PROJECTED 1975-90

Year	Number of active dentists	Rate per 100,000 population[1]
1960	90,120	50.1
1970	102,220	50.2
1975	111,990	52.1
1980	126,170	55.6
1985	140,950	58.9
1990	154,910	61.8

[1] Resident population as of July 1.

Source: 1960 and 1970 active dentists: BHRD, Division of Dental Health.

Population: U.S. Bureau of the Census. *Current Population Reports*. Series P-25, Nos. 468, 477, and 483.

Note: Graduates of University of Puerto Rico have been excluded from projected additions to the supply.

Chapter 6 • OPTOMETRISTS

Optometrist data cover all active optometrists in the 50 States and the District of Columbia. Those few U.S. optometrists who may be overseas or in the territories are excluded. Although current estimates cover both Federal and non-Federal optometrists, historical data provided for years prior to 1960 relate only to civilian workers. However, since there were few military optometrists prior to 1960, this has little effect on the data.

The primary sources of information on active optometrists which are used here are (1) the 1968 Vision and Eye Care Manpower Survey conducted by the National Center for Health Statistics (NCHS) and (2) data from the 1960 and earlier Censuses of Population. The 1968 survey, which is the most recent comprehensive survey of optometrists in the United States, provides the basic data for most of the estimates presented in this report. The age distribution obtained from the survey was assumed to be as of December 31, 1968.

To derive 1970 estimates used for characteristics data and as the base for the projections, it was necessary to build upon the 1968 NCHS data for December 31, 1968. Estimates were thus made of new entrants to and separations from the active supply of optometrists for the period January 1, 1969 through December 31, 1970.

Entrants to optometry were based on graduates of optometry schools for the 1968-70 period, which were obtained from school reports on FY 1971 institutional grant applications. These new graduates were added to the base-year age distribution of optometrists active as of January 1, 1969. Age-specific separation rates were then applied to the total number of active optometrists and to new entrants for 1969 and 1970.[1] The estimated "losses" (deaths and retirements) were then subtracted by age group from the active pool, to derive a December 31, 1970 figure.

The historical supply trends shown represent a combination of both estimates and actual counts and should be used with caution. Individual tables provide detailed explanations and sources for specific items.

In order to improve the data base, the Bureau of Health Resources Development (BHRD) contracted with the American Optometric Association (AOA) to make recommendations on how best to improve the base and is now supporting the AOA in collecting base data on optometrists. The AOA-BHRD survey of all active optometrists in the United States, which began in September 1972 and will continue through early 1974, is being conducted through State licensing boards. In addition to basic demographic items, the survey is obtaining information on principal form of employment, type of activity, continuing education, auxiliary utilization, and patient load. Upon completion of data collection, this survey will become the data base for the profession. Survey results for several States have already been published.

CURRENT CHARACTERISTICS AND TRENDS

In 1970, there were approximately 18,400 optometrists actively engaged in practice in the U.S. Optometrists are relatively old compared to the total labor force, with more than three out of five optometrists 45 years of age and older, and thus expected to retire over the next 20 years. Only about 15 percent were between 25 and 39 years of age. This relatively older age distribution reflects the large number of optometrists who completed their education immediately after World War II and the Korean War, as well as a subsequent drop off in enrollment in optometric schools. (See Table 50.)

In 1970, only about 400 optometrists, or 2 percent of the total active number, were women. This is expected to rise somewhat in the future, however, as a result of the recent increases in enrollment of females in optometry schools. The survey of health professions student finances conducted by the Bureau of Health Manpower Education in 1970, shows that 3 percent of optometry students were women.

Blacks and other minority groups are also underrepresented in optometry according to data from the 1970 Census of Population.[2] Census figures for 1970 indicate that Blacks accounted for less than 1 percent of active optometrists and persons of Spanish heritage for slightly less than 2 percent. Although current and more comprehensive data on racial-ethnic distribution will not be available until results of the current survey are known, the census data are believed to indicate reasonably well the proportion of selected minority groups in the optometric profession.

The East and West North Central, New England, and Pacific geographic divisions had higher ratios of active optometrists per 100,000 population than the United States average. The New England and Pacific States had the highest ratio, 11 per 100,000 each, with the lowest (6 per 100,000) being found in the South Atlantic division.

[1] Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review* 94: 49-55, June 1971.

[2] U.S. Bureau of the Census. *United States Census of Population: 1970. Detailed Characteristics. United States Summary.* Final Report PC(1)-D1. U.S. Government Printing Office, 1973.

Table 50.

NUMBER OF ACTIVE OPTOMETRISTS, BY SEX AND BY AGE GROUP: DECEMBER 31, 1970

Sex and age group	Number of active optometrists	Percent distribution
Both sexes	18,400	100.0
Male	18,050	97.9
Female	390	2.1
All ages	18,400	100.0
Less than 25 years	220	1.2
25-44 years	6,730	36.3
25-29	1,230	6.6
30-34	1,040	5.6
35-39	1,630	8.8
40-44	2,830	15.3
45-64 years	9,890	53.4
45-49	3,630	19.6
50-54	3,140	17.0
55-59	1,990	10.7
60-64	1,140	6.1
65 years and over	1,600	8.6
65-69	720	3.9
70-74	450	2.4
75 and over	430	2.3

Source: Based on data in: Mount, Henry S. and Hudson, Bettie L. *Optometrists Employed in Health Services.* DHEW Pub. No. (HSM) 73-1803. U.S. Government Printing Office, 1973.

Note: Figures may not add to totals and subtotals due to independent rounding.

Among individual States, optometrist/population ratios ranged from a high of approximately 14 per 100,000 population in Illinois, Rhode Island, and South Dakota to a low of about 5 per 100,000 population in Maryland and Alabama. There appears to be a tendency for optometry students to locate in the areas where they went to school, as 8 out of 12 schools of optometry are located in three geographic divisions with large numbers of optometrists—the East North Central, Middle Atlantic, and Pacific divisions. (See Table 51.)

Nearly all optometrists (96 percent) classify themselves primarily as being in general practice. The remaider were in the contact lens specialty (2 percent) or had major professional activities in developmental vision, visual training, or other fields. (See Table 52.) It should be noted, however, that many optometrists have secondary activities in which they spend some time. Furthermore, there appears to be an increasing trend toward specialization, as 9 percent of optometrists graduating in 1965-68 reported their major professional activity to be in an area other than general practice, while only 4 percent of those who graduated in 1961-64 reported such major activities.

As Table 53 shows, about three-fourths of the total supply of optometrists were in solo practice in 1970, 13,600 out of 18,400. About one out of eight were in a partnership with other optometrists. Of the remainder, approximately 1,000 were employed by another optometrist. There appears to be a definite trend away from solo practice; the 1968 survey showed 68 percent of the optometrists who graduated in 1961-64 as being in solo practice, compared with only 46 percent of those who graduated in 1965-68.

Over the past four decades, the number of active optometrists has more than doubled, increasing from 8,400 to 18,400 (See Table 54.) The largest part of the increase took place in the 1930-50 period, when the number grew by three-fourths from 8,400 to 14,750 and the ratio of active optometrists to population rose from 6.8 per 100,000 to 9.8 per 100,000. However, during the decade of the 1950's, the ratio dropped, reaching 9.0 per 100,000 in 1960, and has remained relatively stable since that time, even though the number of optometrists increased somewhat during this period, from 14,100 in 1960 to 18,400 in 1970.

It should be noted that this analysis used historical data from the decennial censuses of population and the 1968 NCHS survey of optometrists. Supply estimates for intervening years between 1960 and 1968 were interpolated. Taken together, the historical series shows an increase in the ratio of active optometrists to population through 1950, a decrease in the ratio to the mid-1960's, and a subsequent increase to 1968.

In contrast to the series shown, the American Optometric Association utilizes the *Blue Book of Optometrists*[3] as the source of its historical estimates of active optometrists. Taking actual counts of listings from this directory, the AOA assumes 90 percent of all optometrists listed in the Blue Book are active. The 90 percent figure was developed from various State studies of optometrists in the 1960's, and it was assumed that the same percentage could be applied nationally and to earlier historical data. Using this method, the AOA shows decreasing ratios of active optometrists from 1950 to 1968 (11.8 optometrists per 100,000 population in 1950; 11.0 in 1960; and 9.3 in 1968).

In evaluating this discrepancy, it should be noted that a number of optometrists may have been located in jewelry

[3] American Optometric Association. *Blue Book of Optometrists.* St. Louis, Mo., The Association, Annual issues.

Table 51.

NUMBER OF ACTIVE OPTOMETRISTS AND OPTOMETRIST/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: DECEMBER 31, 1970

Division and State	Number of active optometrists	Resident population July 1, 1970 (in 1,000's)	Rate per 100,000 population
UNITED STATES	18,400	203,805	9.0
NEW ENGLAND	1,330	11,873	11.2
Connecticut	260	3,039	8.6
Maine	110	995	11.1
Massachusetts	720	5,699	12.6
New Hampshire	70	742	9.4
Rhode Island	130	951	13.7
Vermont	40	447	8.9
MIDDLE ATLANTIC	3,420	37,272	9.2
New Jersey	680	7,195	9.5
New York	1,610	18,260	8.8
Pennsylvania	1,140	11,817	9.6
SOUTH ATLANTIC	1,940	30,773	6.3
Delaware	40	550	7.3
District of Columbia	70	753	9.3
Florida	500	6,845	7.3
Georgia	260	4,602	5.6
Maryland	180	3,937	4.6
North Carolina	310	5,091	6.1
South Carolina	150	2,596	5.8
Virginia	270	4,653	5.8
West Virginia	150	1,746	8.6
EAST SOUTH CENTRAL	850	12,823	6.6
Alabama	180	3,451	5.2
Kentucky	240	3,224	7.4
Mississippi	130	2,216	5.9
Tennessee	290	3,932	7.4
WEST SOUTH CENTRAL	1,370	19,396	7.1
Arkansas	150	1,926	7.8
Louisiana	220	3,644	6.0
Oklahoma	240	2,572	9.3
Texas	760	11,254	6.8
EAST NORTH CENTRAL	4,190	40,367	10.4
Illinois	1,620	11,137	14.5
Indiana	510	5,208	9.8
Michigan	700	8,901	7.9
Ohio	940	10,688	8.8
Wisconsin	420	4,433	9.5
WEST NORTH CENTRAL	1,670	16,367	10.2
Iowa	330	2,830	11.7
Kansas	240	2,248	10.7
Minnesota	350	3,822	9.2
Missouri	420	4,693	8.9

See footnotes at end of table.

Table 51.

NUMBER OF ACTIVE OPTOMETRISTS AND OPTOMETRIST/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: DECEMBER 31, 1970—Continued

Division and State	Number of active optometrists	Resident population July 1, 1970 (in 1,000's)	Rate per 100,000 population
WEST NORTH CENTRAL—Continued			
Nebraska	150	1,490	10.1
North Dakota	70	618	11.3
South Dakota	90	666	13.5
MOUNTAIN	720	8,345	8.6
Arizona	130	1,792	7.3
Colorado	180	2,225	8.1
Idaho	90	717	12.6
Montana	90	697	12.9
Nevada	40	493	8.1
New Mexico	70	1,018	6.9
Utah	70	1,069	6.5
Wyoming	40	334	12.0
PACIFIC	2,950	26,589	11.1
Alaska	20	305	6.6
California	2,240	19,994	11.2
Hawaii	60	774	7.8
Oregon	270	2,102	12.8
Washington	350	3,414	10.3

Source: Active optometrists: Based on data in: Mount, Henry S. and Hudson, Bettie L. *Optometrists Employed in Health Services.* DHEW Pub. No. (HSM) 73-1803. U.S. Government Printing Office, 1973.
Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 468.

Note: Figures may not add to totals and subtotals due to independent rounding.

stores in earlier years and consequently may not have been reported as optometrists in the censuses of population. This might account in part, for variations between the respective census and AOA series reflecting possible census underestimates of active optometrists during this period.

In line with other historical series presented in this report, trend estimates presented for active optometrists are generally consistent with series shown in other publications of the Department of Health, Education, and Welfare. However, the problem of inconsistencies between the sources of information is being studied more intensively, in order to isolate other factors which may have accounted for the discrepancies. Such an examination may result in a subsequent revision of the historical series provided in this chapter.

Although there was relatively slow growth in active optometrists in the 1960's, enrollments in optometry schools began to increase sharply during this period. Over the last decade, total enrollment in optometry schools increased by more than 160 percent, from 1,181 in the 1961-62 academic year to 3,094 in 1971-72. (See Table 55.) The number of graduates more than doubled, from 321 in 1961-62 to 683 in 1971-72. Two new schools were opened during the decade, in Alabama and New York.

PROJECTIONS OF THE SUPPLY OF OPTOMETRISTS TO 1990

Projections of the supply of active optometrists to 1990 are presented here, using several different assumptions as to graduate input.

METHODOLOGY AND ASSUMPTIONS

Estimates of the number of active optometrists for 1971-90 were calculated using essentially the same methodology used to estimate the December 31, 1970

Table 52.

NUMBER OF ACTIVE OPTOMETRISTS, BY MAJOR PROFESSIONAL ACTIVITY: DECEMBER 31, 1970

Major professional activity	Number of active optometrists	Percent distribution
All activities	18,400	100.0
General practice	17,800	96.5
Contact lenses	370	2.0
Visual training	60	0.3
Developmental vision	90	0.5
Low vision aids	10	(1)
Industrial vision	40	0.2
Other	90	0.5

[1] Less than 0.05 percent.

Source: Based on data in: Mount, Henry S. and Hudson, Bettie L. *Optometrists Employed in Health Services.* DHEW Pub. No. (HSM) 73-1803. U.S. Government Printing Office, 1973.

Note: Figures may not add to totals due to independent rounding.

Table 53.

NUMBER OF ACTIVE OPTOMETRISTS BY TYPE OF PRACTICE: DECEMBER 31, 1970

Type of practice	Number of active optometrists	Percent distribution
All types	18,400	100.0
Solo practice	13,560	73.5
Partnership	2,190	11.9
Group practice	530	2.9
Government	40	0.2
For optometrist	960	5.2
For ophthalmologist	130	0.7
For other physician	40	0.2
Firm or corporation	630	3.4
Nonprofit organization/institution	200	1.1
Other	170	0.9

Source: Based on data in: Mount, Henry S. and Hudson, Bettie L. *Optometrists Employed in Health Services.* DHEW Pub. No. (HSM) 73-1803. U.S. Government Printing Office, 1973.

Note: Figures may not add to totals due to independent rounding.

Table 54.

TREND IN NUMBER OF ACTIVE OPTOMETRISTS AND OPTOMETRIST/POPULATION RATIOS: SELECTED YEARS 1930-70

Year	Number of active optometrists[1,2]	Resident population[2] (in 1,000's)	Active optometrists per 100,000 population
1930[3]	8,377	122,775	6.8
1940[3]	10,450	131,669	7.9
1950[3]	[4] 14,750	150,697	9.8
1960	[5] 16,081	179,323	9.0
1963	16,700	189,922	8.8
1965	17,200	194,578	8.8
1967	17,900	198,492	9.0
1968	18,426	200,415	9.2
1970	[6] 18,400	205,056	9.0

[1] For 1930, data are for civilian gainful workers; for 1940-60, data cover experienced civilian labor force; figures for 1963-70 cover all licensed optometrists in the United States.

[2] Data for 1930-60 are as of April 1, data for 1963-70 are as of December 31.

[3] Excludes data for Alaska and Hawaii.

[4] The American Optometric Association has estimated active optometrists at 17,796, which would yield 11.8 per 100,000 population.

[5] The American Optometric Association has estimated active optometrists at 19,688, which would yield 11.0 per 100,000 population.

[6] The 1970 Decennial Census of Population provides a figure of 17,219 active optometrists, which would yield 8.4 per 100,000 population.

Source: 1930, 1940 active optometrists: Kaplan, David L. and Casey, M. Claire. *Occupational Trends in the United States 1900 to 1950.* Bureau of the Census Working Paper No. 5. U.S. Department of Commerce, 1958.

1950, 1960 active optometrists: U.S. Bureau of the Census. *United States Census of Population: 1960. Detailed Characteristics.* United States Summary. PC (1) - 1D. U.S. Government Printing Office, 1963.

1963-67, 1970 active optometrists: BHRD, Division of Manpower Intelligence.

1968 active optometrists: Mount, Henry S. and Hudson, Bettie L. *Optometrists Employed in Health Services.* DHEW Pub. No. (HSM) 73-1803. U.S. Government Printing Office, 1973.

1930-60 population: U.S. Bureau of the Census. *Statistical Abstract of the United States 1966.* U.S. Government Printing Office, 1966.

1963-70 population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 475.

Table 55.

TREND IN NUMBER OF SCHOOLS, ENROLLMENTS, AND GRADUATES FOR OPTOMETRY SCHOOLS: ACADEMIC YEARS 1960-61 THROUGH 1971-72

Academic year	Number of schools	Total enrollment	First-year enrollment	Graduates
1960-61	10	1,118	401	321
1961-62	10	1,181	427	295
1962-63	10	1,284	466	347
1963-64	10	1,372	516	336
1964-65	10	1,547	593	377
1965-66	10	1,745	643	413
1966-67	10	1,882	669	481
1967-68	10	1,962	646	477
1968-69	10	2,203	771	441
1969-70	11	2,488	786	445
1970-71	11	2,831	884	528
1971-72	12	3,094	906	683

Source: 1960-61 through 1963-64: Pennell, Maryland Y. and Delong, Merrill B. Optometric Education and Manpower. *Journal of the American Optometric Association* 41: 941-956, November 1970.

1964-65 through 1971-72: Bernstein, Stuart. Optometric Education Statistics. *Journal of the American Optometric Association* 43: 869-872, August 1972.

figure (described earlier). Data on graduates of optometry schools for 1971 were obtained from school reports on FY 1972 capitation grant applications; these applications also provided estimates of projected enrollments and graduates through 1974-75. Graduate data for 1976-78 were computed from the number of first-year students reported 4 years earlier, utilizing an attrition rate of 10 percent (in both the basic and the alternative supply projections), based on the experience of recent years. Thus, 90 percent of entering optometry students are expected to graduate 4 years later.[4] Although the projected estimates of supply would differ according to the attrition rates used, slight variations in the attrition patterns of optometric students have only a minor impact on the overall supply estimates. Under the basic methodology, for example, if the attrition rate used was 9 percent, there would be only about 200 additional graduates over the 20-year period.

Separation rates (i.e., death and retirement rates) used in the basic methodology and in the alternative approaches were largely based on age-specific rates for males developed by the Department of Labor.[5] Unlike physicians, as indicated earlier, there was no evidence to suggest that optometrists, on the average, tend to live longer than males in the general working population. For this reason age-specific mortality rates developed by the Department of Labor were applied in this report to the optometrist population.

In contrast to the mortality experience, however, information does exist that suggests variations in retirement patterns between optometrists and all working males. For example, in comparing total male labor force participation rates with age-specific proportions of optometrists that are active (1968 NCHS Survey data), it was found that, in general, a higher proportion of optometrists were "active" for each age group. Based on these findings, published age-specific retirement rates for all male workers were adjusted to better reflect the apparent experience, indicated for optometrists. Over the projection period use of the adjusted series reduced estimated retirements of optometrists 25 percent below that obtained by not undertaking such a modification. (See Appendix A for further detail on assumptions, rationale, and methodology utilized to estimate losses to the profession resulting from deaths and retirements.)

The most critical assumption underlying the future supply of optometrists is very clearly the future enrollment in schools of optometry. As indicated earlier, optometry enrollments have increased rapidly since the early 1960's. Current Federal legislation encourages continued increases in enrollment in optometry schools to 1974-75, and therefore a concomitant increase in graduates to 1978. In projecting the total supply beyond 1978, certain assumptions were made as to the output of graduates of optometry schools after that period.

The assumption utilized to develop the "basic" projection of optometrists to 1990 assumes an increase in first-year enrollment after 1975 similar to the increase achieved by the schools prior to the initial Federal legislation. The assumption was made that first-year enrollment beginning in the 1975-76 academic year would increase annually at a rate equivalent to that experienced in the 12-year period prior to enactment of the Health Professions Education Assistance Act of 1963 (about 3.4 percent annually). This period was adopted as a reasonable estimate for enrollment growth in the absence of massive Federal programs targeted specifically at increasing enrollment in optometric schools.

Two alternative assumptions as to graduate additions were also made. First, under a "low" assumption, the number of graduates after 1978 was held constant. The assumption was that there would be no further increase in first-year enrollment after 1974-75 (following expiration of the Comprehensive Health Manpower Training Act of 1971). Public and private support would continue in such a

[4] Pennell, Maryland Y. and Delong, Merrill B. Optometric Education and Manpower. *Journal of the American Optometric Association* 41: 941-956, November 1970.

[5] Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review* 94: 49-55, June 1971.

form to maintain the level of enrollment achieved under the Act but not to further increase the level.

The second or "high" estimate assumes that the rate of increase in first-year enrollment beyond 1974-75 would be midway between the average rate of increase in first-year enrollment experienced by existing optometry schools from 1964-65 to 1971-72 (excluding the two new schools opened during this period) and the average annual rate of increase under the basic methodology. Under this alternative, an average annual increase in first-year enrollment of 5.4 percent was assumed. This assumption, in contrast to that in the basic methodology, reflects increases in enrollment greater than that experienced in the 12-year period prior to the initial legislation. However, the rate of increase would still be less than the increases achieved under legislation since 1963. (See Table 56.)

The projected number of enrollees can be interpreted in terms of an enrollee-per-school measure. The reasonableness of the projections, consequently, can be evaluated by examining the implications of this measure. Under the basic methodology, an increase is projected in first-year enrollment per school from 80.4 in 1970-71 to 127.8 in 1986-87 (a 59 percent increase over a 16-year period). It should be noted that first year enrollment in 1960 for 10 schools averaged 40 students per school (all schools being at normal enrollment for that time, having classes at all levels of the educational program). Thus an increase of 100 percent in first-year enrollment per school took place in the 1960's, considerably greater than the projected increase. If one excluded from this analysis the school at the University of Alabama, which opened in 1969-70, this increase in first-year enrollment in existing schools during the 1960's would even be somewhat higher.

In evaluating these changes, it is difficult to determine whether the schools in existence in 1960 were operating at full capacity at that time or whether the projections imply full capacity in the future. It should be noted, however, that modifications in curricula or the utilization of existing facilities over a longer period of time during the year could take place, a situation which would permit the schools to serve more students without necessarily increasing plant size.

Table 56.

FIRST-YEAR ENROLLMENTS AND GRADUATES IN OPTOMETRY SCHOOLS UNDER BASIC AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1970-71 AND 1971-72; PROJECTED 1972-73 THROUGH 1989-90

Academic year	First-year enrollment			Graduates		
	Basic methodology	Alternative assumptions		Basic methodology	Alternative assumptions	
		Low	High		Low	High
1970-71	884	884	884	528	528	528
1971-72	906	906	906	683	683	683
1972-73	990	990	990	691	691	691
1973-74	1,005	1,005	1,005	775	775	775
1974-75	1,027	1,027	1,027	817	817	817
1975-76	1,062	1,035	1,082	891	891	891
1976-77	1,098	1,035	1,140	904	904	904
1977-78	1,135	1,035	1,202	924	924	924
1978-79	1,174	1,035	1,267	956	930	974
1979-80	1,214	1,035	1,335	988	930	1,026
1980-81	1,255	1,035	1,407	1,022	930	1,082
1981-82	1,298	1,035	1,483	1,057	930	1,140
1982-83	1,342	1,035	1,563	1,093	930	1,202
1983-84	1,388	1,035	1,647	1,130	930	1,266
1984-85	1,435	1,035	1,736	1,168	930	1,335
1985-86	1,484	1,035	1,830	1,208	930	1,407
1986-87	1,534	1,035	1,929	1,249	930	1,482
1987-88	–	–	–	1,292	930	1,562
1988-89	–	–	–	1,336	930	1,647
1989-90	–	–	–	1,381	930	1,736

Source: 1970-71 through 1974-75: Applications for capitation grants submitted to BHRD.

PROJECTION FINDINGS

The projection developed using the basic methodology results in a total gross graduate input of 20,093 for the 1970-90 period. The low alternative projects a total gross graduate input of 17,373, and the high alternative, 22,072. The high and low alternatives consequently produce total gross graduate inputs approximately 4,700 graduates apart. However, it is essential to note that if Federal support should continue at the high levels of the late 1960's and early 1970's and the projected rate of increase were to match the 1967-72 experience (about 7.5 percent a year), a total gross graduate input of 24,528 would result for the 1971-90 period.

Using the basic methodology, the supply of active optometrists is projected to grow from 18,400 in 1970 to 21,800 in 1980, and to 28,000 in 1990. (See Table 57.) The growth in active optometrists is thus projected at 3,400 between 1970 and 1980, a somewhat larger increase than the 2,700 gain from 1960 to 1970. However, in percentage terms, this is only slightly larger than the increase experienced in the 1960 to 1970 period—18 percent as compared with 14 percent. Between 1980 and 1990, growth is projected to be more rapid—a 6,200 increase, or 28 percent.

The ratio of active optometrists to population, which was relatively constant between 1960 and 1970, is projected to begin to rise in the years ahead. The ratio is projected at 9.6 per 100,000 population in 1980, and 11.2 per 100,000 in 1990; this compares with a ratio of 9.0 in 1970.

Under the high alternative projection, the supply of active optometrists is projected to increase to 21,900 in 1980 and to 29,900 in 1990. This represents a 19-percent increase between 1970 and 1980, and a 36-percent increase between 1980 and 1990. Under the low alternative, the supply of active optometrists is projected at 21,700 in 1980 and 25,300 in 1990. The percentage increase would be 17 percent in the 1970-80 period and 18 percent in the 1980-90 period.

The supply projection of active optometrists in 1990 under the basic methodology yields a supply that is 2,700 or 11 percent more than the low estimate, and 1,900 or 6 percent fewer than the higher estimate. The low alternative yields 6,900 (38 percent) more optometrists in 1990 than in 1970, while the high alternative projects 11,500 or 62 percent more optometrists than in 1970. Under the basic methodology, the supply is projected to increase by 9,600 or by 52 percent.

The low alternative yields a population ratio of 10.1 optometrists per 100,000 in 1990, compared with 11.9 per 100,000 in the high estimate and 11.2 per 100,000 under the basic methodology.

Table 57.

SUPPLY OF ACTIVE OPTOMETRISTS AND OPTOMETRIST/POPULATION RATIOS, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 AND 1970; PROJECTED 1975-90

Projection series	1960	1970	1975	1980	1985	1990
	Number of active optometrists					
Basic methodology	16,100	18,400	19,700	21,800	24,500	28,000
Alternatives:						
Low	16,100	18,400	19,700	21,700	23,600	25,300
High	16,100	18,400	19,700	21,900	25,100	29,900
	Rate per 100,000 population[1]					
Basic methodology	8.9	9.0	9.2	9.6	10.2	11.2
Alternatives:						
Low	8.9	9.0	9.2	9.6	9.9	10.1
High	8.9	9.0	9.2	9.6	10.5	11.9

[1] Resident population as of July 1 for 50 States and the District of Columbia.

Source: 1960 active optometrists: Bureau of the Census. *United Census of Population: 1960. Detailed Characteristics.* United States Summary. PC(1)-1D. U.S. Government Printing Office, 1963.

1970 active optometrists: Based on data in: Mount, Henry S. and Hudson, Bettie L. *Optometrists Employed in Health Services.* DHEW Pub. No. (HSM) 73-1803. U.S. Government Printing Office, 1973.

Population: U.S. Bureau of the Census. *Current Population Reports,* Series P-25, Nos. 468, 477, and 483.

Chapter 7 • PHARMACISTS

Data on pharmacists cover all active pharmacists in the 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands. Those few U.S. pharmacists who may be overseas are excluded. Although current estimates include both Federal and non-Federal pharmacists, historical data provided for years prior to 1950 relate only to civilian workers.

The primary sources of information on active pharmacists used here are: the 1966 Survey of Pharmacists conducted by the National Center for Health Statistics (NCHS); the 1970 Licensure Statistics Census of the National Association of Boards of Pharmacy (NABP); and censuses of population. The 1966 NCHS Survey and the NABP licensure statistics provide the basic data for most of the estimates presented. Although data from the NABP Census are not consistent with data from the censuses of population, trend data on active pharmacists from NABP appear to be internally consistent. Nevertheless, historical trends shown represent a combination of both estimates and counts and should be used with caution. Individual tables provide detailed explanations and sources.

The Bureau of Health Resources Development (BHRD) has contracted with the American Association of Colleges of Pharmacy (AACP) to make recommendations on how best to improve the data base and is now supporting the AACP in improving the data on pharmacists. The AACP-BHRD survey of all active pharmacists in the United States, which began in September 1972 and will continue through mid-1974, is being conducted through State licensing boards. In addition to basic demographic items, detailed data are being collected on principal form of employment, type of activities, equipment used, auxiliary utilization, and persons served. Upon completion of data collection, this survey will become the most recent data base for the profession. Survey results for several States have already been published.

CURRENT CHARACTERISTICS AND TRENDS

In 1970, there were approximately 129,300 pharmacists actively engaged in practice in the United States. Pharmacists are a relatively young group, with nearly two out of three under 50 years of age and thus expected to continue in the profession for at least the next 15 years. Over 40 percent of all pharmacists in 1970 were less than 40 years old. This relatively young age distribution reflects the increasing enrollments in schools of pharmacy over the past decade. (See Table 58.)

Compared with other health professions (except registered nurses), pharmacy has a high proportion of women. According to the National Association of Boards of Pharmacy, as seen in Table 58, 11,700, or 9 percent, of active pharmacists were women. This proportion is expected to rise in the future as a result of the recent increases in enrollment of females in pharmacy schools. *The American Journal of Pharmaceutical Education* shows that 24 percent of pharmacy students in 1971 were women.[1]

Blacks comprised slightly more than 2 percent of active pharmacists in 1970, according to data from the 1970 Population Census.[2] The proportion of persons of Spanish heritage was also relatively small, slightly less than 2 percent. Current and more comprehensive data on racial-ethnic distribution will not be available until results of the current AACP-BHRD survey are known.

In 1970, pharmacists were disproportionately located in the Northeast—the Middle Atlantic and New England divisions had the highest ratios, 76 per 100,000—with the lowest (54 per 100,000) being found in the South Atlantic division. (See Table 59.)

Among individual States, pharmacist/population ratios ranged from a high of 85 per 100,000 population in Pennsylvania and Massachusetts to a low of 27 per 100,000 in Hawaii. Unlike other health fields, pharmacists are not found in greatest numbers in geographic divisions where there are the most schools of pharmacy. The Middle Atlantic division, which has the highest ratio of active pharmacists to population, and the South Atlantic, which has the lowest ratio, have the same number of schools of pharmacy—12.

More than four out of five active pharmacists in 1970 were working in community pharmacies, with 35 percent being owners or partners and 47 percent employees. Slightly fewer than 1 in 10 active pharmacists were employed in hospital pharmacies. Four percent were in manufacturing and wholesale activities, and 5 percent were in teaching, government, or other activities. (See Table 60.)

Over the past four decades, the number of active pharmacists rose by about 45,000, or an increase of 50 percent. However, the ratio of active pharmacists to population decreased during this period from 68 per 100,000 in 1930 to 62 per 100,000 in 1971. (See Table 61.)

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[1] American Association of Colleges of Pharmacy. Report on Enrollment in Schools and Colleges of Pharmacy, First Semester, Term, or Quarter, 1971-72. *American Journal of Pharmaceutical Education* 36: 120-130, February 1972.

[2] U.S. Bureau of the Census. *United States Census of Population: 1970. Detailed Characteristics. United States Summary.* Final Report PC(1)-D1. U.S. Government Printing Office, 1973.

Table 58.

NUMBER OF ACTIVE PHARMACISTS, BY AGE GROUP AND SEX: DECEMBER 31, 1970

Age group	Both sexes		Male		Female	
	Number	Percent distribution	Number	Percent distribution	Number	Percent distribution
All ages[1]	129,300	100.0	117,620	100.0	11,670	100.0
Less than 25 years	3,860	3.0	3,150	2.7	710	6.1
25-49 years	79,610	61.6	70,930	60.3	8,680	74.4
25-29	21,270	16.4	17,910	15.2	3,360	28.8
30-39	31,630	24.5	28,470	24.2	3,160	27.1
40-49	26,720	20.7	24,560	20.9	2,160	18.5
50-64 years	34,660	26.8	32,880	28.0	1,780	15.3
50-59	22,170	17.1	20,950	17.8	1,220	10.4
60-64	12,500	9.7	11,930	10.1	570	4.8
65 years and over	11,150	8.6	10,650	9.1	500	4.3
65-69	5,770	4.5	5,520	4.7	260	2.2
70-74	3,260	2.5	3,110	2.6	150	1.2
75 and over	2,120	1.6	2,020	1.7	100	0.8

[1] Includes active pharmacists in 50 States, District of Columbia, Puerto Rico, and the Virgin Islands.

Source: Total active pharmacists: National Association of Boards of Pharmacy. 1971 Proceedings. *Licensure Statistics and Census of Pharmacy*. Chicago, The Association, 1972.
Age and sex distribution based on data in: Reinhart, George R. *Pharmacy Manpower*. Public Health Service Pub. No. 1000-Series 14 - No. 2. U.S. Government Printing Office, 1969.

Note: Figures may not add to totals and subtotals due to independent rounding.

While there was relatively slow growth in the supply of active pharmacists in the 1960's, enrollments in pharmacy schools began to increase sharply in the last decade, total enrollment increased by 77 percent, from 10,730 in the 1962-63 academic year to 18,956 in 1972-73. The annual number of graduates has increased by more than one-third, from 3,728 in 1962 to 4,858 in 1972. (See Table 62.)

PROJECTIONS OF THE SUPPLY OF PHARMACISTS TO 1990

Projections of the total supply of active pharmacists are shown here under several assumptions as to graduate input. In addition, projections of the supply of active pharmacists are presented on the basis of sex and full-time equivalencies.

METHODOLOGY AND ASSUMPTIONS

Estimates of the number of active pharmacists for 1971-90 take into account the estimates of active pharmacists (by age) as of January 1, 1971, new pharmacy graduates, and attrition to both groups. Beginning with the base-year age distribution of pharmacists, new graduates were added year by year to those pharmacists active as of January 1, and age-specific separation rates were applied to the number of active pharmacists each January 1, including new graduates.[3] Estimated "losses" (death and retirements) were then subtracted, by age group, from the active pool, with the pool being aged by 1 year each time.

Data on graduates of pharmacy schools for 1971 were obtained from school reports on FY 1972 capitation grant applications. These applications also provided estimates of projected third-to-last-year enrollment through 1974-75. (Third-to-last-year enrollment was used in order to standardize pharmacy programs of varying lengths.[4]) Graduate data were computed for both the basic methodology and the alternative supply assumptions up to 1978 from the number of third-to-last-year students reported 3 years earlier.

[3] Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review* 94: 49-55, June 1971.
[4] See footnote 3, Chapter 2.

Table 59.

NUMBER OF ACTIVE PHARMACISTS AND PHARMACIST/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: DECEMBER 31, 1970

Division and State	Number of active pharmacists	Resident population July 1, 1970 (in 1,000's)	Rate per 100,000 population
All locations	129,300	206,579	62.6
United States	128,200	203,805	62.9
NEW ENGLAND	8,990	11,873	75.7
Connecticut	2,450	3,039	80.5
Maine	470	995	46.7
Massachusetts	4,840	5,699	84.9
New Hampshire	330	742	45.0
Rhode Island	700	951	73.7
Vermont	210	447	45.9
MIDDLE ATLANTIC	28,300	37,271	75.9
New Jersey	4,330	7,195	60.1
New York	13,930	18,260	76.3
Pennsylvania	10,050	11,817	85.0
SOUTH ATLANTIC	16,500	30,772	53.6
Delaware	250	553	45.1
District of Columbia	620	753	82.1
Florida	4,290	6,845	62.7
Georgia	2,870	4,602	62.3
Maryland	2,220	3,937	56.4
North Carolina	2,040	5,091	40.0
South Carolina	1,520	2,596	58.4
Virginia	1,990	4,653	42.7
West Virginia	720	1,746	41.2
EAST SOUTH CENTRAL	7,420	12,823	57.3
Alabama	2,120	3,451	61.5
Kentucky	1,620	3,224	50.2
Mississippi	1,130	2,216	51.1
Tennessee	2,550	3,932	64.9
WEST SOUTH CENTRAL	11,860	19,397	61.1
Arkansas	1,010	1,926	52.5
Louisiana	2,350	3,644	64.4
Oklahoma	2,120	2,572	82.5
Texas	6,380	11,254	56.7
EAST NORTH CENTRAL	23,720	40,368	58.7
Illinois	6,020	11,137	54.1
Indiana	3,120	5,208	59.9
Michigan	5,640	8,901	63.4
Ohio	6,550	10,688	61.3
Wisconsin	2,390	4,433	53.8
WEST NORTH CENTRAL	9,680	16,367	59.1
Iowa	1,520	2,830	53.6
Kansas	1,440	2,248	63.8
Minnesota	2,310	3,822	60.4

Table 59.

NUMBER OF ACTIVE PHARMACISTS AND PHARMACIST/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: DECEMBER 31, 1970—Continued

Division and State	Number of active pharmacists	Resident population July 1, 1970 (in 1,000's)	Rate per 100,000 population
WEST NORTH CENTRAL—Continued			
Missouri	2,600	4,693	55.5
Nebraska	1,030	1,490	68.9
North Dakota	340	618	54.5
South Dakota	450	666	67.3
MOUNTAIN	5,440	8,345	65.2
Arizona	1,060	1,792	59.1
Colorado	1,600	2,225	71.9
Idaho	510	717	71.1
Montana	420	697	60.8
Nevada	340	493	69.0
New Mexico	570	1,018	55.9
Utah	730	1,069	67.9
Wyoming	220	334	64.4
PACIFIC	16,330	26,589	61.4
Alaska	100	805	31.8
California	12,000	19,994	60.0
Hawaii	210	774	26.6
Oregon	1,390	2,102	66.1
Washington	2,640	3,414	77.3
Puerto Rico	1,030	2,712	37.8
Virgin Islands	30	62	41.9

Source: Active pharmacists: National Association of Boards of Pharmacy. 1971 Proceedings. *Licensure Statistics and Census of Pharmacy*. Chicago, The Association, 1972.

Population: U.S. Bureau of the Census. *Current Population Reports*. Series P-25, No. 468. *United States Census of Population: 1970. Number of Inhabitants*. Puerto Rico, Virgin Islands. PC(1)-53A, 55A. U.S. Government Printing Office, 1972.

Note: Figures may not add to totals and subtotals due to independent rounding.

In order to incorporate into the projections the trend toward increasing enrollment of females in pharmacy schools, male and female third-to-last-year students were independently projected by simple linear regression from 1960-71 AACP enrollment figures to 1988. The derived proportions of male and female students were applied to distribute total third-to-last-year enrollment figures according to sex. Based on the experience of recent years, differential attrition rates of 16.3 percent for males and 13.7 percent for females were utilized to generate respective male and female graduate components to 1990. Under this attrition assumption, 83.7 percent of the male and 86.3 percent of the female third-to-last year-students are expected to graduate 3 years later.[5]

Although projected estimates of supply would vary with different attrition rates, slight variations in the attrition patterns of pharmacy students would appear to have a negligible impact on the overall supply estimates. However, were an undifferentiated (by sex) 10 percent attrition rate applied to third-to-last-year students, under the basic

[5]Progress Report, Pharmacy Manpower Information Project. *American Journal of Pharmaceutical Education* 36: 396-401, August 1972.

Table 60.

NUMBER OF ACTIVE PHARMACISTS, BY TYPE OF EMPLOYER: DECEMBER 31, 1970

Type of employer	Number of active pharmacists[1]	Percent distribution
All types	129,300	100.0
Community pharmacy owner or partner	45,890	35.5
Community pharmacy employee	60,510	46.8
Hospital pharmacy	11,840	9.2
Manufacturing and wholesale	4,750	3.6
Teaching, government, and other	6,310	4.9

[1] Includes active pharmacists in 50 States, District of Columbia, Puerto Rico, and Virgin Islands.

Source: National Association of Boards of Pharmacy. 1971 Proceedings. *Licensure Statistics and Census of Pharmacy*. Chicago, The Association, 1972.

methodology used in this report, an additional 8,000 graduates could be expected over the 20-year projection period. Also, graduate supply would be affected somewhat by the assumed increase in the proportion of female third-to-last-year students (to 32 percent in 1987-88), since a continuing lower attrition rate for females is anticipated. But the differences, as presently seen, are small. Under the basic methodology, for example, if the proportion of female third-to-last-year students were maintained at 24 percent (the 1970-71 rate), and the above differential attrition rates were observed, a decrease of only about 500 graduates would be expected over the projection period.

Separation rates used in the basic methodology and alternative approaches were derived from age-specific rates for males developed by the Department of Labor[6] and from unpublished data for women in the labor force developed by the Bureau of Labor Statistics. These age-specific separation rates are for the general labor force. Although separation patterns are not currently available for pharmacists, it should be noted that their experience may not be identical with that of men and women in the general labor force. Male pharmacists, for example, may tend to stay in the labor force longer than the general population.

The death rate of the general population was assumed to be representative of that of pharmacists. A brief literature search for this group uncovered no empirical evidence suggesting longer life spans than the general population. However, to the extent that life expectancy of pharmacists may be longer than the national average, the death rates used here somewhat overstate losses to the profession. Similarly, if male pharmacists' retirement patterns were lower than those of the total labor force, then the projected supply of active pharmacists would be understated somewhat. For example, if the retirement rates of male pharmacists more closely approximate those of optometrists (about 50 percent lower than the general labor force for those over 50 years of age), the projected total active supply of pharmacists would increase by nearly 6,200 for 1980 and 6,500 for 1990 under the basic methodology—to 152,300 and 156,400 respectively. But studies substantiating such a trend are lacking. Indeed, there is evidence suggesting that the retirement patterns of male pharmacists may more closely approximate those of the general labor force; the proportion of pharmacists employed in community pharmacies (those who are probably more representative of the general labor force) is increasing, while the proportion of self-employed pharmacists, those more likely to retire at a later age, is decreasing. This observation and its implications are reinforced by a comparison between data from the 1960 and 1970 Census of Population showing the proportion of pharmacists as private wage and salary workers to have increased by about 12 percent, while self employed pharmacists dropped by about 13 percent.

Although no definitive data exist on the separation or reentry patterns of female pharmacists, the separation rates presently used for females may somewhat underestimate losses. Allowing a 7-percent higher separation rate of females would decrease the total active supply of females shown in Table 66 by about 900 for 1980 and 2,200 for 1990, under the basic methodology, to 19,800 and 33,000 respectively. The overall proportion of females in the total active supply, however, is only slightly affected.

The basic determinant of the future supply of pharmacists is very clearly the enrollment in colleges of pharmacy. As indicated earlier, pharmacy enrollments have increased rapidly since the 1960's, and current legislation encourages continued increases in enrollment in pharmacy schools to 1974-75, and thus a concomitant increase in graduates to 1977. In projecting the total supply to 1980 and 1990, the basic assumptions relate entirely to the output of graduates of pharmacy schools after 1977.

The basic projection methodology assumes an increase in third-to-last-year enrollment after 1974-75 that would be similar to the increase achieved by the schools prior to the initial Federal legislation. The assumption was made that third-to-last-year enrollments beginning in 1975-76 would increase annually at a rate equivalent to that experienced in the 6-year period prior to enactment of the Health Professions Education Assistance Act of 1963 (about 1.5 percent annually). This period was adopted as a reasonable approximation of enrollment growth that might occur

[6] Fullerton, Howard N. *op. cit.*

Table 61.

TREND IN NUMBER OF ACTIVE PHARMACISTS AND PHARMACIST/POPULATION RATIOS: SELECTED YEARS 1900-71

Year	Number of active pharmacists[1,2]	Resident population[2] (in 1,000's)	Active pharmacists per 100,000 population
1900[3]	46,200	75,995	60.8
1910[3]	54,300	91,972	59.0
1920[3]	64,200	105,711	60.7
1930[3]	83,800	122,775	68.2
1940[3]	82,600	131,669	62.7
1950[3]	[4] 89,200	150,697	59.2
1960	[5] 117,800	181,668	64.8
1964	118,800	192,468	61.7
1968	123,500	200,415	61.6
1970	[6] 128,200	205,056	62.5
1971	129,700	207,336	62.6

[1] For 1900-30, data are for civilian gainful workers; for 1940-50, data cover experienced civilian labor force; figures for 1960-71 cover licensed pharmacists in 50 States and District of Columbia.

[2] Data for 1900 are as of June 1; 1910, April 15; 1920, January 1; 1930-50, April 1; 1960-71, December 31.

[3] Excludes data for Alaska and Hawaii.

[4] The 1950 Decennial Census of Population provides a figure of 90,307 active pharmacists, which would yield 59.0 per 100,000 population.

[5] The 1960 Decennial Census of Population provides a figure of 92,700 active pharmacists, which would yield 51.0 per 100,000 population.

[6] The 1970 Decennial Census of Population provides a figure of 109,647 active pharmacists, which would yield 53.5 per 100,000 population.

Source: 1900-40 active pharmacists: Kaplan, David L. and Casey, M. Claire. *Occupational Trends in the United States 1900 to 1950.* Bureau of the Census Working Paper No. 5. U.S. Department of Commerce, 1958.

1950 active pharmacists: U.S. Bureau of the Census. *United States Census of Population: 1960. Detailed Characteristics.* United States Summary. PC(1)-1D. U.S. Government Printing Office, 1963.

1960-71 active pharmacists: National Association of Boards of Pharmacy. 1972 Proceedings. *Licensure Statistics and Census of Pharmacy.* Chicago, The Association, 1973.

1900-50 population: U.S. Bureau of the Census. *Statistical Abstract of the United States 1966.* U.S. Government Printing Office, 1966.

1960-71 population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 475.

despite the absence of massive Federal programs aimed at increasing enrollments.

Two alternative assumptions as to graduate additions were also made. First, as a low projection, the number of graduates after 1978 was held constant. The assumption here is that there will be no further increases in third-to-last-year enrollment after 1974-75 (coincident with expiration of the Comprehensive Health Manpower Training Act of 1971), since public and private support would be continued in such a form that increases in enrollment achieved under the Act through 1974-75 would be maintained, but no further increases in enrollment encouraged (See Table 63.)

The second or high estimate assumes that the rate of increase in third-to-last-year enrollment beyond 1974-75 would be midway between the average rate of increase experienced by existing pharmacy schools from 1964-65 to 1971-72 and the average annual rate of increase under the basic methodology. Under this alternative consequently, an average annual increase in third-to-last-year enrollment of 3.7 percent was used. This alternative, in contrast with the basic methodology, assumes increases in enrollment greater than that experienced prior to the period of major Federal support. However, the rate of increase would not be of the magnitude achieved since 1963, given the absence of further massive Federal support to increase enrollment.

Table 62.

TREND IN NUMBER OF SCHOOLS, ENROLLMENTS, AND GRADUATES FOR PHARMACY SCHOOLS: ACADEMIC YEARS 1960-61 THROUGH 1972-73

Academic year	Number of schools	Enrollment		Graduates
		Total[1]	Third-to-last year	
1960-61	76	[2] 13,556	[2] 5,797	3,445
1961-62	76	10,893	[3] 2,181	3,728
1962-63	76	10,730	4,145	4,188
1963-64	76	[2] 10,291	[2] 4,390	[2,3] 2,195
1964-65	75	12,104	4,491	3,393
1965-66	74	12,495	4,647	3,704
1966-67	74	13,221	5,234	3,782
1967-68	74	14,274	5,616	4,035
1968-69	74	14,932	5,469	4,291
1969-70	74	15,323	5,532	4,766
1970-71	74	15,626	5,864	4,746
1971-72	74	16,808	6,532	4,858
1972-73	73	18,956	7,546	N.A.

[1] Includes enrollments in the last 3 years of pharmacy programs leading to degrees of B.S., B. Pharm., and Pharm. D.

[2] Excludes data for University of Puerto Rico which were not available.

[3] The sharp drop from the preceding year reflects the transition from a 4-year to a 5-year post-high school program in 1960 by those pharmacy schools which were not already on a 5-year program.

Source: Report on Enrollment in Schools and Colleges of Pharmacy First Semester, Term, or Quarter, 1972-73. *American Journal of Pharmaceutical Education* 37: 138-153, February 1973. Also prior annual reports.

Report of Degrees Conferred by Schools and Colleges of Pharmacy for the Academic Year 1971-72. *American Journal of Pharmaceutical Education* 37: 126-137, February 1973. Also prior annual reports.

Data for the University of Puerto Rico for 1964-65 through 1970-71 were obtained from: Applications for institutional and capitation grants submitted to BHRD.

Note: The last 3 years of pharmacy programs are used in order to have comparable data for pharmacy schools with different types of programs. Pharmacy schools with 3-year programs require 2 years of college for admission. Other pharmacy schools have 5-year programs and accept students directly from high school.

Hampton College (an unaccredited school) is omitted from all data.

Projection Findings. The basic projection of the size of future graduating classes results in a total gross graduate input of 126,931 for the 1971-90 period. The low alternative projects a total gross graduate input of 118,394 and the high alternative, 151,139. The high and low alternatives consequently produce total gross graduate inputs approximately 32,745 graduates apart. However, if Federal support were to continue at the high levels of the early 1970's and the projected rate of increase were to match the 1967-72 experience (about 6 percent a year), a total gross graduate input of 169,500 would result for the 1971-90 period.

A measure of the reasonableness of the projections can be derived by examining the implications of the increase in the projected numbers of third-to-last-year enrollees per pharmacy school. An increase in third-to-last-year enrollment after 1975, similar to the increase achieved by the schools prior to the initial legislation, is assumed under the basic methodology. In line with this assumption, an increase is projected in third-to-last-year enrollment per pharmacy school from 76.9 in 1970-71 to 121.3 in 1987-88 (a 58 percent increase over a 17-year period). During the 1962-63 academic year, third-to-last-year enrollment averaged 53.8 enrollees per school. The increase to 1970-71 was 43 percent over an 8-year period. The projection period is twice as long as the 1962-63 to 1970-71 period.

In the projection methodology utilized in this report, no new pharmacy schools are assumed to be opening during the 1970-90 period. This is consistent with the fact that new pharmacy schools were not established during the

Table 63.

THIRD-TO-LAST YEAR ENROLLMENTS AND GRADUATES IN PHARMACY SCHOOLS UNDER BASIC AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1970-71 AND 1971-72; PROJECTED 1972-73 THROUGH 1989-90

Academic year	Third-to-last year enrollment			Graduates		
	Basic methodology	Alternative assumptions		Basic methodology	Alternative assumptions	
		Low	High		Low	High
1970-71	5,914	5,914	5,914	4,746	4,746	4,746
1971-72	6,633	6,633	6,633	4,573	4,573	4,573
1972-73	6,908	6,908	6,908	4,985	4,985	4,985
1973-74	7,117	7,117	7,117	5,592	5,592	5,592
1974-75	7,297	7,297	7,297	5,826	5,826	5,826
1975-76	7,406	7,333	7,567	6,002	6,002	6,002
1976-77	7,517	7,333	7,847	6,156	6,156	6,156
1977-78	7,630	7,333	8,137	6,249	6,187	6,385
1978-79	7,744	7,333	8,438	6,344	6,189	6,622
1979-80	7,860	7,333	8,750	6,440	6,189	6,868
1980-81	7,978	7,333	9,074	6,538	6,191	7,124
1981-82	8,098	7,333	9,410	6,637	6,191	7,388
1982-83	8,219	7,333	9,758	6,738	6,192	7,664
1983-84	8,342	7,333	10,119	6,840	6,194	7,948
1984-85	8,467	7,333	10,493	6,943	6,195	8,243
1985-86	8,594	7,333	10,881	7,048	6,196	8,549
1986-87	8,723	7,333	11,284	7,155	6,197	8,867
1987-88	8,854	7,333	11,702	7,263	6,197	9,196
1988-89	–	–	–	7,372	6,198	9,537
1989-90	–	–	–	7,484	6,198	9,892

Source: 1970-71 through 1974-75 third-to-last year enrollments: Applications for institutional and capitation grants submitted to BHRD. 1970-71 graduates: Applications for capitation grants submitted to BHRD.

Note: Figures shown above for 1970-71 through 1972-73 differ from those in table 62. These discrepancies reflect in part the different sources used for the tables.

study period preceding Federal legislation. The assumption is advanced, consequently, that all projected enrollment increases will take place among existing schools. It is difficult to determine whether pharmacy schools are now operating at capacity or will be at capacity during the projection period. However, it is entirely possible that changes in the pharmacy curriculum or utilization of existing facilities throughout the year would permit existing schools to serve a greater number of students than are presently enrolled.

Under the basic methodology outlined earlier, the supply of active pharmacists is projected to grow from 129,300 in 1970 to 146,100 in 1980, and to 179,900 in 1990, as shown in Table 64. The growth in active pharmacists is thus projected at 16,800 between 1970 and 1980, compared with a 11,500 increase from 1960 to 1970. The projected increase represents a larger percentage gain in 1970-80 than that experienced between 1960 and 1970—73 percent as compared with 10 percent. Between 1980 and 1990, growth in supply is projected to be more rapid—a 33,800 increase, or 23 percent.

The ratio of active pharmacists to population, which was relatively constant between 1960 and 1970, is projected to rise sharply. The ratio is projected at 64 per 100,000 population in 1980, and 72 per 100,000 in 1990. This compares with a ratio of 63 per 100,000 in 1970.

Under the high alternative projection, the supply of active pharmacists is projected to increase to 146,900 in 1980 and 194,200 in 1990. This represents a 14 percent increase between 1970 and 1980, and a 32 percent increase between 1980 and 1990. Under the low alternative, the supply of active pharmacists is projected at 145,600 in 1980 and 171,800 in 1990.

The projection of active pharmacists in 1990 under the basic assumption yields a supply that is 8,100 (or 5 percent) more than the low estimate and 14,300 (or 8

Table 64.

SUPPLY OF ACTIVE PHARMACISTS AND PHARMACIST/POPULATION RATIOS, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 AND 1970; PROJECTED 1975-90

Projections series	1960	1970	1975	1980	1985	1990
	Number of active pharmacists[1]					
Basic methodology	117,800	129,300	133,800	146,100	161,800	179,900
Alternatives:						
Low	117,800	129,300	133,800	145,600	158,700	171,800
High	117,800	129,300	133,800	146,900	167,100	194,200
	Rate per 100,000 population[2]					
Basic methodology	65.5	63.4	62.3	64.4	67.6	71.8
Alternatives:						
Low	65.5	63.4	62.3	64.2	66.3	68.5
High	65.5	63.4	62.3	64.7	69.8	77.5

[1] Includes licenced pharmacists in practice in 50 States and the District of Columbia; for 1970-90 also includes those in Puerto Rico and the Virgin Islands.

[2] Resident population as of July 1 for 50 States and the District of Columbia. Rate for 1970 differs from that shown in table 59 because of exclusion of Puerto Rico and the Virgin Islands from population base in this table.

Source: 1960 and 1970 active pharmacists: National Association of Boards of Pharmacy. 1961 and 1971 Proceedings. *Licensure Statistics and Census of Pharmacy*. Chicago, The Association, 1962 and 1972.
Population: U.S. Bureau of the Census. *Current Population Reports*. Series P-25, Nos. 468, 477, and 483.

percent) fewer than the high estimate. The low alternative yields a population ratio of 68 pharmacists per 100,000 in 1990, compared with 78 per 100,000 in the high estimate and 72 per 100,000 under the basic assumption.

As noted earlier, a definite upward trend in the proportion of women enrolled in pharmacy schools is evident, and there is no reason to believe that this trend is temporary or sporadic. Also noted was the fact that the attrition rate of female students is lower than that of males, resulting in an even greater proportion of female graduates over time.

The increasing proportion of women in pharmacy is important because of the much shorter work-life-expectancy of female professionals and thus their lower professional productivity per pharmacist.[7] There are indications that women pharmacists have a work-life-expectancy about one-half that of the average male pharmacist.[8] Further, women pharmacists have been shown to practice full-time, on the average, about half and part-time about one-fourth of their professional lives. It is therefore reasonable to assume that two part-time pharmacists are approximately equivalent to one full-time pharmacist, based on a 40-hour work week. Converting the projected active supply of female pharmacists to full-time equivalents yields the estimate of active full-time pharmacists to 1990 under the basic methodology shown in Table 65.

A comparison of this table with the projected total active supply of pharmacists shown in Table 64 (basic methodology) reveals that the full-time equivalency conversion lowers the 1990 supply estimate by about 5 percent. This procedure reduces the projected 1980 estimate by about 4 percent while the 1970 estimate would be lowered by about 2 percent.

If the alternative separation patterns that were mentioned earlier are examined in terms of numbers of full-time equivalent pharmacists, considerable differences in the above totals are possible.

To illustrate, if female separation rates remain as adopted under the basic methodology, but male death and retirement patterns are lower, e.g., closer to those of optometrists, the 1980 and 1990 projected total full-time equivalent pharmacists would be 147,100 and 177,500 for 1980 and 1990 respectively. However, should female

[7] Ohvall, R.A. and Sehgel, K.S. Practice Continuity and Longevity of Women Pharmacists. *Journal of the American Pharmaceutical Association* NS9: 518-520, October 1969.

[8] Tash, R.H.; Dickson, W.M.; and Rodowskas, C.A., Jr. Women in the Professional Work Force. *Journal of the American Pharmaceutical Association* NS13:622-624, November 1973.

separation rates be 7 percent higher than those presently assumed, and male separation rates approximate those of the general labor force (as assumed), the resultant total full-time equivalent pharmacists for 1980 and 1990 would be 140,300 and 169,400 respectively, departing only slightly from the figures presented in Table 64.

Table 65.

SUPPLY OF ACTIVE PHARMACISTS AND FULL-TIME EQUIVALENTS, BY SEX, USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1975-90

Year	Number of active pharmacists[1]		Active full-time equivalents[2]	
	Male	Female	Both sexes	Female
1970	117,600	11,700	126,400	8,800
1975	118,700	15,100	130,000	11,300
1980	125,400	20,700	140,900	15,500
1985	134,400	27,400	155,000	20,600
1990	144,700	35,200	171,000	26,400

[1] Includes active pharmacists in 50 States, District of Columbia, Puerto Rico, and Virgin Islands.
[2] Equals full-time workers plus 50 percent of part-time workers.

Source: 1970 active pharmacists: National Association of Boards of Pharmacy. 1971 Proceedings. *Licensure Statistics and Census of Pharmacy*. Chicago, The Association, 1972.

Table 66.

SUPPLY OF ACTIVE PHARMACISTS, BY SEX, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 AND 1970; PROJECTED 1975-90

Projection series	1960	1970	1975	1980	1985	1990
	Number active male pharmacists[1]					
Basic methodology	111,300	117,600	118,700	125,400	134,400	144,700
Alternatives:						
Low	111,300	117,600	118,700	125,000	132,100	138,800
High	111,300	117,600	118,700	126,000	138,300	155,000
	Number active female pharmacists[1]					
Basic methodology	6,500	11,700	15,100	20,700	27,400	35,200
Alternatives:						
Low	6,500	11,700	15,100	20,600	26,600	33,000
High	6,500	11,700	15,100	20,900	28,800	39,200

[1] Includes licensed pharmacists in practice in 50 States and the District of Columbia; for 1970-90 also includes those in Puerto Rico and the Virgin Islands.

Source: 1960 and 1970 active pharmacists: National Association of Boards of Pharmacy. 1961 and 1971 Proceedings. *Licensure Statistics and Census of Pharmacy*. Chicago, The Association, 1962 and 1972.

Chapter 8 • PODIATRISTS

Data on podiatrists cover all active members of the profession in the 50 States and the District of Columbia, but not those few podiatrists who may be overseas or in the territories. The primary source of information on active podiatrists used here is the 1970 Survey of Podiatrists conducted by the National Center for Health Statistics (NCHS), which has an early 1970 reference point. To derive the December 31, 1970 estimates used for characteristics data and as the base for the projections, estimates were made of new entrants to and separations from the supply of active podiatrists during 1970. The methodology for making these estimates was the same as that used for optometrists and is described in Chapter 6.

Because podiatrists were included with physicians in decennial census estimates up to 1970, there are few historical data on the profession. Historical trends shown here represent a combination of estimates and counts and should be used with caution. Individual tables provide detailed explanations and notes of sources.

In order to provide an improved data base, the Bureau of Health Resources Development (BHRD) is cooperating with NCHS to conduct a survey of podiatrists in the United States in 1974. This survey will be based on an update of the mailing list developed by NCHS for conducting its 1970 survey. The survey instrument will be similar to the 1970 questionnaire, requesting basic information on demographic characteristics and such items as principal form of employment, type of practice, use of auxiliaries, and patient load.

CURRENT CHARACTERISTICS AND TRENDS

In 1970, there were approximately 7,100 podiatrists actively practicing in the United States. Podiatrists as a group were older than some other health professions, with nearly two out of three podiatrists being 45 years of age or older. (See Table 67.) Only 14 percent were between 30 and 39 years of age. This age distribution reflects the large number of podiatrists who completed their education immediately after World War II and the Korean War, and also the subsequent dropoff in enrollment in podiatry schools.

In 1970, 300 or 4 percent of active podiatrists were women. This proportion may decrease somewhat in the future, as a result of recent decreases in enrollment of females in podiatry schools. The survey of health professions student finances conducted by the Bureau of Health Manpower Education shows that less than 2 percent of podiatry students in 1970 were women.

Blacks make up a small proportion of podiatrists. According to data from the 1970 Census of Population[1], Blacks accounted for slightly more than 4 percent of active podiatrists in 1970. The census indicates, furthermore, that only 1.3 percent of the total supply was accounted for by podiatrists of Spanish heritage.

[1] U.S. Bureau of the Census. *United States Census of Population: 1970. Detailed Characteristics. United States Summary.* Final Report PC(1)-D1. U.S. Government Printing Office, 1973.

Table 67.

NUMBER OF ACTIVE PODIATRISTS, BY SEX AND BY AGE GROUP: DECEMBER 31, 1970

Sex and age group	Number of active podiatrists	Percent distribution
Both sexes	7,100	100.0
Male	6,800	96.0
Female	300	4.0
All ages	7,100	100.0
Less than 25 years	120	1.7
25-44 years	2,380	33.1
25-29	670	9.4
30-34	340	4.7
35-39	640	8.9
40-44	730	10.1
45-64 years	3,810	53.2
45-49	950	13.2
50-54	1,000	14.0
55-59	950	13.2
60-64	920	12.8
65 years and over	830	11.5
65-69	400	5.5
70-74	270	3.7
75 and over	160	2.3

Source: Estimates by sex: Koch, Hugo K. and Phillips, Hazel M. *Podiatry Manpower: A General Profile. United States - 1970.* DHEW Pub. No. (HRA) 74-1805. U.S. Government Printing Office, 1973.

Estimates by age: Based on unpublished data from 1970 survey.

Note: Figures may not add to totals and subtotals due to independent rounding.

In 1970, podiatrists were disproportionately located in the New England and Middle Atlantic States which had higher ratios of active podiatrists per 100,000 population than the other geographic divisions, 5.7 and 6.1 respectively. The lowest ratio (0.9 per 100,000) is found in the East South Central States.

Among individual States, podiatrist/population ratios ranged from a high of 7.0 per 100,000 in Massachusetts and New York, to a low of about 0.5 and 0.4 per 100,000 population respectively, in South Carolina and Mississippi. There appears to be a tendency for students to locate in the areas where they went to school, as all five schools of podiatry in 1970 were located in the three divisions with the largest number of podiatrists—the Middle Atlantic, East North Central, and Pacific divisions. (See Table 68.)

Nearly all podiatrists in 1970 (90 percent) classified themselves as being in general practice, as shown in Table 69. The remaining podiatrists were in surgery (6 percent) or

Table 68.

NUMBER OF ACTIVE PODIATRISTS AND PODIATRIST/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: DECEMBER 31, 1970

Division and State	Number of active podiatrists	Resident population July 1, 1970 (in 1,000's)	Rate per 100,000 population
UNITED STATES	7,100	203,805	3.5
NEW ENGLAND	680	11,873	5.7
Connecticut	180	3,039	5.9
Maine	20	995	2.2
Massachusetts	400	5,699	7.0
New Hampshire	20	742	2.8
Rhode Island	60	951	5.9
Vermont	10	447	1.3
MIDDLE ATLANTIC	2,290	37,271	6.1
New Jersey	360	7,195	5.0
New York	1,240	18,260	6.8
Pennsylvania	690	11,817	5.8
SOUTH ATLANTIC	600	30,772	1.9
Delaware	20	550	4.0
District of Columbia	60	753	7.6
Florida	190	6,845	2.8
Georgia	60	4,602	1.2
Maryland	100	3,937	2.5
North Carolina	60	5,091	1.1
South Carolina	10	2,596	0.5
Virginia	60	4,653	1.2
West Virginia	40	1,746	2.5
EAST SOUTH CENTRAL	110	12,823	0.9
Alabama	20	3,451	0.6
Kentucky	60	3,224	1.7
Mississippi	10	2,216	0.4
Tennessee	30	3,932	0.7
WEST SOUTH CENTRAL	290	19,397	1.5
Arkansas	20	1,926	0.9
Louisiana	40	3,644	1.1
Oklahoma	50	2,572	1.8
Texas	190	11,254	1.7

Table 68.

NUMBER OF ACTIVE PODIATRISTS AND PODIATRIST/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: DECEMBER 31, 1970—Continued

Division and State	Number of active podiatrists	Resident population July 1, 1970 (in 1,000's)	Rate per 100,000 population
EAST NORTH CENTRAL	1,690	40,368	4.2
Illinois	600	11,137	5.4
Indiana	150	5,208	2.8
Michigan	270	8,901	3.1
Ohio	530	10,688	5.0
Wisconsin	130	4,433	3.0
WEST NORTH CENTRAL	370	16,367	2.2
Iowa	90	2,830	3.3
Kansas	50	2,248	2.0
Minnesota	80	3,822	2.0
Missouri	90	4,693	1.8
Nebraska	40	1,490	2.8
North Dakota	10	618	1.0
South Dakota	20	666	2.3
MOUNTAIN	200	8,345	2.4
Arizona	40	1,792	2.1
Colorado	70	2,225	3.2
Idaho	20	717	2.2
Montana	10	697	2.0
Nevada	20	493	3.2
New Mexico	20	1,018	2.0
Utah	30	1,069	2.3
Wyoming	10	334	1.5
PACIFIC	840	26,589	3.2
Alaska	(1)	305	–
California	740	19,994	3.7
Hawaii	10	774	0.6
Oregon	40	2,102	1.7
Washington	60	3,414	1.9

[1] Less than 5.

Source: Active podiatrists: Koch, Hugo K. and Phillips, Hazel M. *Podiatry Manpower: A General Profile. United States - 1970.* DHEW Pub. No. (HRA) 74-1805. U.S. Government Printing Office, 1973.
Population: U.S. Bureau of the Census. Current Population Reports. Series P-25, No. 468.

Note: Figures may not add to totals and subtotals due to independent rounding.

had primary activities in foot orthopedics or other fields. Many podiatrists, of course, have secondary activities in which they spend some time. Furthermore, there appears to be an increasing trend toward specialization, as 24 percent of the podiatrists under 35 years of age reported their primary activity to be in an area other than general practice, while only 6 percent of those 45 years and over reported such primary activities in 1970.

As Table 70 shows, about 86 percent of the supply of active podiatrists were in solo practice in 1970, 6,100 out of 7,100. Six percent (460) were in a partnership with other podiatrists. Here too, there appears to be a definite trend, as the 1970 survey showed 90 percent of podiatrists 45 years of age and over as being in solo practice, compared with only 62 percent of those under age 35.

Table 69.

NUMBER OF ACTIVE PODIATRISTS, BY MAJOR PROFESSIONAL ACTIVITY: DECEMBER 31, 1970

Major professional activity	Number of active podiatrists	Percent distribution
All activities	7,100	100.0
General practice	6,430	89.9
Surgery	410	5.7
Foot orthopedics	180	2.5
Other[1]	130	1.8

[1] Includes podogeriatrics, podiatric dermatology, roentgenology, and other activities.

Source: Based on unpublished prelimary data from 1970 Survey of Podiatrists by the National Center for Health Statistics.

Note: Figures may not add to totals due to independent rounding.

Table 70.

NUMBER OF ACTIVE PODIATRISTS, BY TYPE OF PRACTICE: DECEMBER 31, 1970

Type of practice	Number of active podiatrists	Percent distribution
All types	7,100	100.0
Solo practice	6,110	85.5
Partnership	460	6.4
Group practice	130	1.8
Government organization	140	2.0
Nongovernment organization, institution	160	2.2
Other	150	2.1

Source: Koch, Hugo K. and Phillips, Hazel M. *Podiatry Manpower: A General Profile. United States - 1970.* DHEW Pub. No. (HRA) 74-1805. U.S. Government Printing Office, 1973.

Note: Figures may not add to totals due to independent rounding.

Over the past two decades, the number of active podiatrists has grown from 6,400 to 7,100. During the 1960-70 period, the number of active podiatrists remained nearly constant, as the number of new graduates entering the profession was offset by deaths and retirements of active practitioners. The ratio of active podiatrists to population decreased from 4.2 per 100,000 in 1950 to 3.9 per 100,000 in 1960. It decreased further to 3.5 per 100,000 in 1970. (See Table 71.)

Enrollments in schools of podiatry have recently begun to increase sharply. In the last decade, total enrollment at podiatry schools increased by nearly 170 percent, from 472 in 1961-62 to 1,267 in 1971-72. (See Table 72.)

Table 71.

TREND IN NUMBER OF ACTIVE PODIATRISTS AND PODIATRIST/POPULATION RATIOS: SELECTED YEARS 1950-70

Year	Number of active podiatrists[1]	Resident population[1] (in 1,000's)	Active podiatrists per 100,000 population
1950[2]	6,400	151,868	4.2
1960	7,000	179,975	3.9
1970	[3] 7,100	205,056	3.5

[1] Data for 1950, 1960 are as of July 1, data for 1970 are as of December 31.

[2] Excludes Alaska and Hawaii.

[3] The 1970 Decennial Census of Population provides a figure of 6,026 active podiatrists, which would yield 2.9 per 100,000 population.

Source: 1950, 1960 active podiatrists: U.S. Department of Health, Education, And Welfare; Public Health Service; Bureau of Health Professions Education and Manpower Training. *Health Manpower Source Book 20. Manpower Supply and Educational Statistics for Selected Health Occupations: 1968.* Public Health Service Pub. No. 263, Section 20. U.S. Government Printing Office, 1969.

1970 active podiatrists: Koch, Hugo K. and Phillips, Hazel M. *Podiatry Manpower: A General Profile. United States - 1970.* DHEW Pub. No. (HRA) 74-1805. U.S. Government Printing Office, 1973.

Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 475.

Table 72.

TREND IN NUMBER OF SCHOOLS, ENROLLMENTS, AND GRADUATES FOR PODIATRY SCHOOLS: ACADEMIC YEARS 1960-61 THROUGH 1971-72

Academic year	Number of schools	Total enrollment	First-year enrollment	Graduates
1960-61	5	478	N.A.	116
1961-62	5	472	120	96
1962-63	4	496	N.A.	114
1963-64	5	585	195	97
1964-65	5	622	177	122
1965-66	5	707	223	135
1966-67	5	838	283	165
1967-68	5	926	291	162
1968-69	5	1,061	331	204
1969-70	5	1,097	293	251
1970-71	5	1,148	351	242
1971-72	5	1,267	399	286

Source: 1960-61 through 1969-70: Pennell, Maryland Y. Podiatric Education and Manpower. *Journal of Podiatric Education* Vol. 1, No. 2, June 1970.
1970-71, 1971-72: Applications for capitation grants submitted to BHRD.

PROJECTIONS OF THE SUPPLY OF PODIATRISTS TO 1990

Several projections of the supply of active podiatrists to 1990 are presented here, using different assumptions as to graduate input over the projection period.

METHODOLOGY AND ASSUMPTIONS

Estimates of the number of active podiatrists for 1971-90 were calculated by using essentially the same methodology as for estimating the December 31, 1970 figure. Data on graduates of podiatry schools for 1971 were obtained from school reports on FY 1972 capitation grant applications; the schools also provided estimates of first-year enrollments and graduates through 1974-75. Graduate projections to 1978 were computed from the number of first-year students reported 4 years earlier, utilizing an attrition rate of 10 percent in both the basic methodology and the alternative supply projections, in line with the experience of recent years.[2] Thus, 90 percent of entering podiatry students are projected to graduate 4 years later. If a different attrition pattern were used, of course, the graduate component would change somewhat, but the overall impact on the total supply estimates would be minor. Under the basic methodology, for example, if a 9-percent attrition was used, only about 100 additional graduates would be expected over the projection period.

Separation rates used in the basic methodology and in the alternative approaches were derived largely from age-specific death and retirement rates for males developed by the Department of Labor.[3] In comparing age-specific data from the Department of Labor showing male labor force participation rates with information on the proportion of podiatrists that are inactive (as obtained from the 1970 NCHS Survey), it was found that a lower proportion of podiatrists were inactive for all age groups 60 years of age and above. This suggested that podiatrists tend to retire at a later age than does the general male labor force. Given this finding, adjustment factors were developed to convert the published age-specific retirement rates for males in the labor force to a series which would better approximate the apparent podiatrist experience. The overall consequence of the utilization of "podiatrist-specific" retirement rates is that retirements are reduced by approximately 15 percent over the 20-year period, compared with the number estimated to retire if the unconverted male labor force rates were used.

Unlike retirement patterns, there is no evidence to suggest that podiatrists, on the average, live longer than persons in the general labor force. Therefore, age-specific mortality rates derived from those developed by the Department of Labor, were simply applied to the podiatrist population. Age-specific separation rates, consequently, represented the sum of individually computed retirement

[2]Pennell, Maryland Y. Podiatric Education and Manpower. *Journal of Podiatric Education* 1:11-21, June 1970.

[3]Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review* 94: 49-55, June 1971.

and mortality rates. (See Appendix A for detailed explanation of the methodology utilized to estimate deaths and retirements.)

The basic determinant of the future supply of podiatrists is very clearly the enrollment in podiatry schools. As indicated earlier, podiatry enrollments have grown rapidly since the early 1960's, with new Federal legislation providing much of the impetus for recent increases in enrollment. In projecting the total supply of podiatrists therefore, several different assumptions were made relating to the output of graduates of podiatry schools after 1978.

The basic assumption utilized to develop the projections of podiatrists was that there would be an increase in first-year enrollment after 1974-75 similar to that achieved by the schools prior to the initial Federal legislation. On this basis, first-year enrollment beginning in 1975-76 was projected to increase annually at a rate equivalent to that experienced in the 12-year period prior to enactment of the Health Professions Education Assistance Act of 1963—about 5 percent annually. (See Table 73.) This period was adopted as a reasonable approximation of enrollment growth occurring in the assumed absence of massive Federal programs to increase enrollment.

Two alternative assumptions as to graduate additions were made. First, as a low projection, the number of graduates after 1978 was held constant, on the assumption that there would be no further increases in first-year enrollment after 1974-75. This means that support from sources other than the Federal government, when combined with Federal funds, would be adequate to support the enrollment level of the mid-1970's, but would not be sufficient to bring about further increases in enrollment.

The second or high estimate assumed that the rate of increase in first-year enrollment beyond 1974-75 would be midway between the average rate of increase experienced by existing podiatry schools from 1964-65 to 1971-72, and the average annual rate of increase under the basic methodology. Under this alternative, consequently, an average annual increase in first-year enrollment of 6.5 percent was assumed. This alternative, in contrast to that of the basic methodology, assumed increases in enrollment greater than that experienced in the 12-year period prior to the initial legislation. However, the rate of increase would still not be of the magnitude achieved under legislation since 1963.

Table 73.

FIRST-YEAR ENROLLMENTS AND GRADUATES IN PODIATRY SCHOOLS UNDER BASIC AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1970-71 AND 1971-72; PROJECTED 1972-73 THROUGH 1989-90

Academic year	First-year enrollment			Graduates		
	Basic methodology	Alternative assumptions		Basic methodology	Alternative assumptions	
		Low	High		Low	High
1970-71	351	351	351	242	242	242
1971-72	399	399	399	286	286	286
1972-73	425	425	425	266	266	266
1973-74	461	461	461	309	309	309
1974-75	506	506	506	368	368	368
1975-76	531	506	539	380	380	380
1976-77	558	506	574	420	420	420
1977-78	586	506	611	455	455	455
1978-79	615	506	651	478	455	485
1979-80	646	506	693	502	455	517
1980-81	678	506	738	527	455	550
1981-82	712	506	786	554	455	586
1982-83	748	506	837	581	455	624
1983-84	785	506	891	610	455	664
1984-85	824	506	949	641	455	707
1985-86	865	506	1,011	673	455	753
1986-87	908	506	1,077	706	455	802
1987-88	—	—	—	742	455	854
1988-89	—	—	—	778	455	910
1989-90	—	—	—	817	455	969

Source: 1970-71 through 1974-75: Applications for capitation grants submitted to BHRD.

The reasonableness of the projections of podiatrists can be evaluated, in part, by examining changes in the number of enrollees per school. Comparisons of changes in this measure can be made between: (1) a period prior to the initial legislation; (2) the situation recently; and (3) the projection period. An increase of nearly 200 percent in first-year podiatry enrollment per school took place in the 9-year period between 1961-62 and 1970-71 (from 24 to 70). This compares with an increase of 159 percent in first-year enrollment per school in the 16-year projection period. As the projection period covers a time span 7 years longer than the observed period of enrollment increase yet projects a rate of increase considerably lower, it would appear that projected increases in enrollment are entirely reasonable in light of historical trends. In view of the fact that the number of podiatry schools (five) has been constant since the mid-1950's and that there are no definite plans for new schools, the projections imply that enrollment increases would take place entirely within these five schools. The issue of whether existing schools are operating at capacity is very difficult to pinpoint. However, it should be pointed out that school capacity possibly could be substantially increased by more effective utilization of facilities as they now exist. This might include curriculum modifications, as well as increasing the yearly use of existing space within a school.

PROJECTION FINDINGS

The basic projection of the graduating classes of 1970-71 through 1989-90 results in a total gross graduate input of 10,325 for that period. The low alternative projects a total gross graduate input of 8,187 and the high alternative, 11,147. The high and low alternatives, consequently, produce total gross graduate inputs approximately 2,900 graduates apart. However, if Federal support continues at the high levels of the late 1960's and early 1970's and the projected rate of increase matches the 1967-72 experience (about 8 percent a year), a total gross graduate input of 12,247 would result for the 1971-90 period.

Utilizing the basic graduate projection outlined above, the supply of active podiatrists is expected to grow from 7,100 in 1970 to 8,500 in 1980 and to 13,000 in 1990. The number of active podiatrists is thus projected to rise 1,400 between 1970 and 1980, compared with an increase of only 100 from 1960 to 1970. Between 1980 and 1990, growth is projected to be more rapid—an increase of 4,500 or 53 percent, compared with 20 percent in the 1970-80 period and no gain between 1960 and 1970. The ratio of active podiatrists to population, which decreased between 1960 and 1970, is projected to increase slightly by 1980 (to 3.7 per 100,000) and then rise sharply to 5.2 per 100,000 population in 1990. (See Table 74.)

Table 74.

SUPPLY OF ACTIVE PODIATRISTS AND PODIATRIST/POPULATION RATIOS, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 AND 1970; PROJECTED 1975-90

Projection series	1960	1970	1975	1980	1985	1990
	Number of active podiatrists					
Basic methodology	7,000	7,100	7,500	8,500	10,300	13,000
Alternatives:						
Low	7,000	7,100	7,500	8,500	9,600	10,900
High	7,000	7,100	7,500	8,600	10,500	13,800
	Rate per 100,000 population[1]					
Basic methodology	3.9	3.5	3.5	3.7	4.3	5.2
Alternatives:						
Low	3.9	3.5	3.5	3.7	4.0	4.3
High	3.9	3.5	3.5	3.8	4.4	5.5

[1] Resident population as of July 1 for 50 States and the District of Columbia.

Source: 1960 active podiatrists: U.S. Department of Health, Education, and Welfare; Public Health Service; Bureau of Health Professions Education and Manpower Training. *Health Manpower Source Book 20. Manpower Supply and Educational Statistics for Selected Health Occupations: 1968.* Public Health Service Pub. No. 263, Section 20. U.S. Government Printing Office, 1969.

1970 active podiatrists: Koch, Hugo K. and Phillips, Hazel M. *Podiatry Manpower: A General Profile. United States - 1970.* DHEW Pub. No. (HRA) 74-1805. U.S. Government Printing Office, 1973.

Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, Nos. 468, 477, and 483.

Under the high alternative projection, the supply of active podiatrists would increase to 8,600 in 1980 and to 13,800 in 1990. This would represent a 21-percent increase between 1970 and 1980, and a 60-percent increase between 1980 and 1990. Under the low alternative, the supply of active podiatrists is projected at 8,500 in 1980 and 10,900 in 1990, or a 20-percent gain during the 1970-80 period and a 28-percent increase during the 1980-90 period.

The supply projection of active podiatrists in 1990 under the basic assumption yields a supply that is 2,100 (19 percent) more than the low estimate and 800 (6 percent) fewer than the high estimate. The low alternative yields a population ratio of 4.3 podiatrists per 100,000 in 1990, compared with 5.5 per 100,000 in the high estimate and 5.2 per 100,000 under the basic assumption.

Chapter 9 • VETERINARIANS

Data on veterinarians cover all active veterinarians in the 50 States, the District of Columbia, Puerto Rico, Virgin Islands, Canal Zone, and Guam. Those few American veterinarians who may be overseas are excluded. Although current estimates cover both Federal and non-Federal veterinarians, historical data provided for years prior to 1950 relate only to civilian workers.

The primary sources of information on active veterinarians used here are the American Veterinary Medical Association (AVMA) and the 1960 and earlier population censuses. Not only are available trend data on active veterinarians severely limited, but the existing data base has serious gaps in coverage, since the AVMA collects data on its members only. Although some data on nonmembers has been collected, little or nothing is known about the location or activities of the estimated 15 percent of all active veterinarians not included in the AVMA data. All estimates by the Association and in this report are based on the known characteristics of those veterinarians in the AVMA master file.

To derive the 1970 estimates used for characteristics data and as the base for the projections, it was necessary to build upon data published by the American Veterinary Medical Association on the age distribution of its members in 1965.[1] Nonmembers of the Association were assumed to have the same age distribution as members. The proportion of active veterinarians in each age group was assumed to be the same as the proportion of the total male population of the same age group who were in the labor force in that year.[2] Veterinarians 55 years of age and over were distributed into individual age groups on the basis of data on graduates (by year), which were also provided by the Association.

In order to derive a December 31, 1970 estimate of active veterinarians, estimates were made of new entrants (i.e., graduates) and separations (i.e., deaths and retirements) to the active supply of veterinarians from the base period January 1, 1966 forward. Data on graduates of veterinary schools for each year were obtained from school reports on FY 1971 institutional grant applications. Beginning with the base year distribution by age, new graduates for each year were added to those veterinarians active as of January 1. Age-specific separation rates were then applied to the number of active veterinarians as of January 1, including new graduates. The estimated "losses" (deaths and retirements) each year were then subtracted by age group from the active pool, to bring the estimate up to December 31, 1970.

Historical trends shown represent a combination of estimates and counts and should be used with caution. Individual tables provide detailed explanations and sources.

The Bureau of Health Resources Development (BHRD) has contracted with the American Veterinary Medical Association to make recommendations on how best to improve the data base. The study will identify specific data gaps within the present veterinary manpower information system and recommend specific ways in which such gaps could be filled, including investigation of data available from resources such as State licensing boards, schools, and association membership lists.

CURRENT CHARACTERISTICS AND TRENDS

In 1970, there were an estimated 25,900 veterinarians actively engaged in practice in the United States. Veterinarians have a relatively young age distribution, with three out of five younger than 45 years of age in 1970, and thus expected to remain in practice over the next 20 years. One out of five veterinarians was under age 30, in contrast to only 4 percent 65 years of age and over. (See Table 75.) This relatively young age distribution reflects the large number of graduates of schools of veterinary medicine in the years after World War II.

According to estimates based upon data from the 1970 Census of Population[3], women accounted for 5 percent of the total active veterinarian work force in 1970. This is expected to rise substantially in the future, however, as a result of the recent increases in enrollment of females in veterinary medical schools. The American Association of Veterinary Medical Colleges reports that 9 percent of students enrolled in the 1970-71 academic year were women.

Blacks are underrepresented in veterinary medicine, according to estimates based upon the 1970 Census of Population.[4] Slightly fewer than 2 percent of all active veterinarians were Black, about the same as in 1960. The proportion of persons of Spanish heritage was also rather small, fewer than 1.3 percent of the total active supply.

Veterinarians are disproportionately located in the West North Central and Mountain divisions, which had higher

[1] Age Distribution of Veterinarians with Projections to 1985. *Journal of the American Veterinary Medical Association* 146: 536-543, March 1, 1965.

[2] Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review* 94: 49-55, June 1971.

[3] U.S. Bureau of the Census. *United States Census of Population: 1970. Detailed Characteristics. United States Summary.* Final Report PC(1)- D1. U.S. Government Printing Office, 1973.

[4] *Ibid.*

Table 75.

NUMBER OF ACTIVE VETERINARIANS, BY SEX AND BY AGE GROUP: DECEMBER 31, 1970

Sex and age group	Number of active veterinarians	Percent distribution
Both sexes	25,900	100.0
Male	24,600	94.9
Female	1,320	5.1
All ages	25,900	100.0
Less than 25 years	580	2.2
25-44 years	15,350	59.0
25-29	4,940	19.0
30-34	2,870	11.0
35-39	4,180	16.1
40-44	3,350	12.9
45-64 years	8,930	34.2
45-49	4,020	15.5
50-54	2,810	10.8
55-59	1,610	6.1
60-64	490	1.8
65 years and over	1,080	4.1
65-69	160	4.6
70-74	260	1.0
75 and over	660	1.5

Source: Total active veterinarians: Based on data on members of American Veterinary Medical Association.

Estimates by sex: Sex distribution of active veterinarians from 1970 Census of Population was applied to the estimated number of active veterinarians.

Estimates by age: Based on data in: Age Distribution of Veterinarians with Projections to 1985. *Journal of the American Veterinary Medical Association* 536, 540-541, 543; September 1, 1964.

Note: Figures may not add to totals and subtotals due to independent rounding.

ratios of active veterinarians per 100,000 population than those in other geographic divisions, 25 and 19 per 100,000 respectively. The lowest ratio (8 per 100,000) was found in the New England division. However, veterinarian population ratios should be used with caution. Veterinarians in many areas are much more proportional to large animals (herd counts) than to small animals, which can be viewed as essentially population-based.

Among individual States, veterinarian/population ratios ranged from a high of 42 per 100,000 population in Iowa to a low of 5 per 100,000 population in West Virginia and Rhode Island. In general, agricultural States with large numbers of farm animals served by veterinarians have the highest ratios of veterinarians to population. (See Table 76.)

As shown in Table 77, more than two out of five veterinarians are primarily in small-animal practice, while one-fourth devote their practice to food animals. Nearly 8 percent are in meat inspection, 6 percent in teaching and research, and 5 percent in regulatory veterinary medicine. Although some veterinarians have secondary activities in which they spend some time, such splitting of practice would appear to be less than in some other health professions; veterinarians who devote their practice to small animals or to food animals do not often have an opportunity to cross over to another area of activity. Furthermore, there appears to be an increasing trend toward small-animal practice as the primary activity. Forty-seven percent of veterinarians who graduated in 1968-71 reported this activity to the Association, in contrast to 39 percent graduating 10 years earlier.

Over the past four decades, the number of active veterinarians has more than doubled, increasing from 11,900 to 25,900. The largest part of the increase took place in the 1950's when the number grew by 40 percent from 13,700 to 19,200. During this period, the ratio of active veterinarians to population rose from 9.1 per 100,000 to 10.7 per 100,000. By 1970, the ratio of active veterinarians to population had risen further to 12.6 per 100,000. (See Table 78.)

As with the growth in active veterinarians in the 1960's, enrollments in schools of veterinary medicine have increased sharply. In the last decade, total enrollment at veterinary medical schools increased by 50 percent, from 3,632 in 1962-63 to 5,439 in 1972-73. The number of graduates increased by 53 percent from 830 in 1963 to 1,271 in 1973. (See Table 79.)

Table 76.

NUMBER OF ACTIVE VETERINARIANS AND VETERINARIAN/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: DECEMBER 31, 1970

Division and State	Number of active veterinarians	Resident population July 1, 1970 (in 1,000's)	Rate per 100,000 population
All locations	25,900	206,708	12.5
United States	25,800	203,805	12.7
NEW ENGLAND	960	11,873	8.0
Connecticut	250	3,093	8.1
Maine	100	995	9.9
Massachusetts	390	5,699	6.8
New Hampshire	90	742	11.6
Rhode Island	50	951	4.9
Vermont	90	447	19.7
MIDDLE ATLANTIC	3,120	37,271	8.4
New Jersey	570	7,195	7.9
New York	1,540	18,260	8.4
Pennsylvania	1,010	11,817	8.5
SOUTH ATLANTIC	3,530	30,772	11.5
Delaware	80	550	14.2
District of Columbia	80	753	10.8
Florida	850	6,845	12.4
Georgia	620	4,602	13.4
Maryland	640	3,937	16.3
North Carolina	410	5,091	8.0
South Carolina	200	2,596	7.8
Virginia	570	4,653	12.2
West Virginia	90	1,746	5.1
EAST SOUTH CENTRAL	1,350	12,823	10.5
Alabama	440	3,451	12.8
Kentucky	350	3,224	10.9
Mississippi	210	2,216	9.7
Tennessee	340	3,932	8.7
WEST SOUTH CENTRAL	2,580	19,397	13.3
Arkansas	210	1,926	11.0
Louisiana	310	3,644	8.4
Oklahoma	420	2,572	16.3
Texas	1,640	11,254	14.6
EAST NORTH CENTRAL	5,010	40,368	12.4
Illinois	1,340	11,137	12.0
Indiana	800	5,208	15.3
Michigan	990	8,901	11.1
Ohio	1,220	10,688	11.4
Wisconsin	670	4,433	15.0
WEST NORTH CENTRAL	4,100	16,367	25.0
Iowa	1,190	2,830	41.9
Kansas	610	2,248	27.1
Minnesota	780	3,822	20.4

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Table 76.

NUMBER OF ACTIVE VETERINARIANS AND VETERINARIAN/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: DECEMBER 31, 1970—Continued

Division and State	Number of active veterinarians	Resident population July 1, 1970 (in 1,000's)	Rate per 100,000 population
WEST NORTH CENTRAL—Continued			
Missouri	760	4,693	16.2
Nebraska	450	1,490	30.3
North Dakota	100	618	16.2
South Dakota	210	666	31.7
MOUNTAIN	1,620	8,345	19.4
Arizona	240	1,792	13.7
Colorado	590	2,225	26.6
Idaho	160	717	22.9
Montana	190	697	26.7
Nevada	80	493	17.2
New Mexico	140	1,018	14.1
Utah	120	1,069	11.3
Wyoming	90	334	26.0
PACIFIC	3,590	26,589	13.5
Alaska	20	305	7.9
California	2,560	19,994	12.8
Hawaii	70	774	8.8
Oregon	320	2,102	15.3
Washington	610	3,414	17.9
Puerto Rico	60	2,712	2.2
Virgin Islands	(1)	62	–
Canal Zone	10	44	22.7
Guam	(1)	85	–

[1] Less than 5.

Source: Active veterinarians: American Veterinary Medical Association
Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 468. *United States Census of Population: 1970. Number of Inhabitants.* Canal Zone, Guam, Puerto Rico, Virgin Islands. PC(1) - 53A, 54A, 55A, 57A. U.S. Government Printing Office, 1972.

Note: Figures may not add to totals and subtotals due to independent rounding.

Table 77.

NUMBER OF ACTIVE VETERINARIANS, BY MAJOR PROFESSIONAL ACTIVITY: DECEMBER 31, 1970

Major professional activity	Number of active veterinarians	Percent distribution	Major professional activity	Number of active veterinarians	Percent distribution
All activities	25,900	100.0	Military veterinary medicine	800	3.1
			Regulatory veterinary medicine	1,270	4.9
Food animal practice	6,430	24.8	Meat inspection	1,940	7.5
Small animal practice	11,280	43.5	Industrial veterinary practice	520	2.0
Equine practice	830	3.2	Teaching and research	1,660	6.4
Laboratory animal practice	360	1.4	Other	540	2.1
Public health	280	1.1			

Source: Based on data in: National Research Council, Committee on Veterinary Medical Research and Education. *New Horizons for Veterinary Medicine*. Washington, National Academy of Sciences, 1972.

Note: Figures may not add to totals due to independent rounding.

Table 78.

TREND IN NUMBER OF ACTIVE VETERINARIANS AND VETERINARIAN/POPULATION RATIOS: SELECTED YEARS 1930-70

Year	Number of active veterinarians[1,2]	Population[2] (in 1,000's)	Active veterinarians per 100,000 population
1930[3]	11,863	122,775	9.7
1940[3]	11,068	131,669	8.4
1950[3]	13,679	150,697	9.1
1959	[4] 19,200	179,386	10.7
1966	22,900	197,656	11.6
1968	24,300	201,678	12.0
1969	25,100	203,777	12.3
1970	[5] 25,900	206,017	12.6

[1] For 1930, data are for civilian gainful workers; for 1940-50, data cover experienced civilian labor force; figures for 1959-70 cover Federal and non-Federal veterinarians in the United States.

[2] Data for 1930-50 are as of April 1; 1959-70, December 31.

[3] Excludes data for Alaska and Hawaii.

[4] The 1960 Decennial Census of Population provides a figure of 14,906 active veterinarians, which would yield 8.3 per 100,000 population.

[5] The 1970 Decennial Census of Population provides a figure of 19,435 active veterinarians, which would yield 9.4 per 100,000 population.

Source: 1930-50 active veterinarians: Kaplan, David L. and Casey, M. Claire. *Occupational Trends in the United States 1900 to 1950*. Bureau of the Census Working Paper No. 5. U.S. Department of Commerce, 1958.

1959 active veterinarians: U.S. Department of Health, Education, and Welfare; Public Health Service; Bureau of Health Professions Education and Manpower Training. *Health Manpower Source Book 20. Manpower Supply and Educational Statistics for Selected Health Occupations: 1968*. Public Health Service Pub. No. 263, Section 20. U.S. Government Printing Office, 1969.

1966-70 active veterinarians: Based on data on members of American Veterinary Medical Association.

1930-50 population: U.S. Bureau of the Census. *Statistical Abstract of the United States 1966*. U.S. Government Printing Office, 1966.

1959-70 population: U.S. Bureau of the Census. *Current Population Reports*. Series P-25, Nos. 368, 456, and 475.

Table 79.

TREND IN NUMBER OF SCHOOLS, ENROLLMENTS, AND GRADUATES FOR VETERINARY SCHOOLS: ACADEMIC YEARS 1960-61 THROUGH 1972-73

Academic year	Number of schools	Total enrollment	First-year enrollment	Graduates[1]
1960-61	18	3,497	983	824
1961-62	18	3,528	1,001	819
1962-63	18	3,632	N.A.	830
1963-64	18	3,727	1,059	834
1964-65	18	3,864	1,139	874
1965-66	18	4,119	1,242	910
1966-67	18	4,388	1,305	963
1967-68	18	4,623	1,315	1,064
1968-69	18	4,779	1,311	1,129
1969-70	18	4,876	1,339	1,165
1970-71	18	5,006	1,430	1,239
1971-72	18	5,149	1,453	1,258
1972-73	18	5,439	1,580	1,271

[1] Senior students.

Source: *Journal of the American Veterinary Medical Association* 163: 36, July 1, 1973. Also prior annual issues.

PROJECTIONS OF THE SUPPLY OF VETERINARIANS TO 1990

Projections of overall supply of active veterinarians are presented here under several different assumptions as to the graduate input over the projection period.

METHODOLOGY AND ASSUMPTIONS

Estimates of the number of active veterinarians for 1971-90 were calculated using essentially the same methodology as for estimating the December 31, 1970 figure; i.e., by adding new graduates and applying age-specific separation rates to the veterinarian pool on a year-by-year basis. Data on graduates of veterinary medical schools for 1971 were obtained from school reports on FY 1972 capitation grant applications; the applications also provided estimates of projected first-year enrollments and graduates through 1974-75. Graduate data up to 1978 were computed from the number of first-year students reported 4 years earlier, utilizing an attrition (or dropout) rate of 7 percent (in both the basic methodology and the alternative supply projections) as indicated by the experience of recent years.[5] Thus 93 percent of entering veterinary students are assumed to graduate 4 years later.[6] Graduate projections for 1977 and beyond also include graduates of the Louisiana State Veterinary Medical School which opened in 1973. Although projected estimates of supply will vary with different attrition rates, slight variations in the dropout patterns of veterinary medical students have only a minor impact on the overall supply estimates. Under the basic methodology, for example, if attrition were reduced to 6 percent, only about 360 additional graduates would be expected over the entire projection period.

Separation rates used in the basic methodology and in the alternative approaches were derived from age-specific rates for males developed by the Department of Labor.[7] In comparing Department of Labor data showing age-specific proportions of the total male labor force that are inactive to the age-specific proportions of veterinarians that are inactive, as obtained from the 1971 AVMA membership data, it was revealed that a lower proportion of veterinarians were inactive for all age groups. This suggested that the pattern of retirements for veterinarians is different than that of the general labor force. Hence, a series of adjustment factors was obtained by dividing the proportion of inactive veterinarians for each age group by the proportion of the total male labor force that is inactive for

[5] No separate adjustment was made for 2 schools with 3-year programs.

[6] Unpublished material prepared by Maryland Y. Pennell and Willard H. Eyestone, Bureau of Health Professions Education and Manpower Training.

[7] Fullerton, Howard N., *op. cit.*

corresponding age groups. These "conversion" factors were then applied to published age-specific retirement rates for males in the labor force in order to obtain age-specific retirement rates that seemed to be more representative for veterinarians. The overall consequence of the utilization of "veterinarian-specific" retirement rates was that retirements were reduced by approximately one-third over the projection period, compared to the number estimated to be retiring if the unadjusted series were used.

There was no evidence to suggest that veterinarians, on the average, live longer than does the general labor force. Consequently, age-specific mortality rates developed by the Department of Labor for all working males were applied to veterinarians. The final age-specific separation series represented the sum of individually computed age-specific retirement and mortality rates.

The basic determinant of the future supply of veterinarians is very clearly the enrollment in schools of veterinary medicine. As indicated earlier, veterinary enrollment has increased rapidly since the early 1960's. In projecting the active supply to 1980 and 1990, three assumptions related to the output of graduates of veterinary medical schools after 1978 were used. The basic assumption underlying the projections of veterinarians to 1990 is an increase in first-year enrollment after 1975 similar to the increase achieved by the schools prior to the initial Federal legislation. The assumption was made that, beginning in 1975-76, first-year enrollment would increase annually at a rate equivalent to that experienced in the 13-year period prior to enactment of the Veterinary Medical Education Act of 1966 (about 1.8 percent annually). The increase during this period was viewed as a reasonable parameter for a future period when it is assumed that there would be no massive Federal programs aimed at increasing enrollment in veterinary medical schools.

Two alternative assumptions as to graduate additions were also made. First, as a low projection, the number of graduates after 1978 was held constant, on the assumption that there would be no further increases in first-year enrollment after 1974-75, coincident with expiration of the Comprehensive Health Manpower Training Act of 1971. This means that a combination of public and private funding would be continued in such a form that increases in enrollment achieved under the Act would be maintained but that no further increases in enrollment would be forthcoming. (See Table 80.)

The second or high estimate assumed that the rate of increase in first-year enrollment beyond 1974-75 would be midway between the average rate of increase in first-year enrollment experienced by existing veterinary medical schools from the 1967-68 to 1971-72 academic years and the average annual rate of increase under the basic methodology. Consequently, this alternative calls for an average annual increase in first-year enrollment of 3 percent. In contrast to the basic methodology, this alternative assumes increases in enrollment greater than that experienced in the 13-year period prior to the initial legislation. However, the rate of increase would not be of the magnitude achieved under legislation since 1967.

In order to better interpret increases in the projected number of enrollees, one can view the projections in terms of an enrollees-per-school measure. The basic methodology assumes increases in first-year enrollment at levels comparable to those achieved by schools before the initial legislation relating to veterinary medicine. An increase in first-year enrollment per school of 39 percent from 1970-71 to 1986-87 is projected under the basic methodology (from 79.4 to 110.5 enrollees per school). This would appear realistic when historical trends are considered. The first-year enrollment per veterinary school in 1960-61 averaged 54.6. The increase to the 1970-71 academic year was 45 percent over the 10-year period. (See Table 79.)

It should be noted that all 18 veterinary schools were at "normal" enrollment throughout the period, having classes at all levels of the educational program. The projections include the opening of only one new school in 1970-80; namely, Louisiana State University during the 1973-74 academic year. On the basis of historical trends prior to the advent of Federal legislation it was assumed that no other schools of veterinary medicine would open during the projection period. To determine whether schools in existence in 1960 or earlier were operating at full capacity at that time or whether the projections of future enrollment imply full capacity, is difficult. It should be noted, however, that the utilization of existing facilities over a greater part of the calendar year and certain modifications in the curriculum would permit the existing schools to serve a greater number of students without necessarily having to increase the physical size of the school.

PROJECTION FINDINGS

The basic methodology projection for the graduating classes of 1970-71 through 1989-90 results in a total gross graduate input of 32,423 for that period. The low alternative projects a total gross graduate input of 30,044 and the high projects 33,987. The high and low alternatives consequently produce total gross graduate inputs approximately 3,900 graduates apart. If Federal spending should continue at the high levels of the late 1960's and early 1970's and the projected rate of increase were to match the 1967-71 experience (about a 5 percent increase yearly), a total gross graduate input of 37,100 would result for the 1971-90 period.

Table 80.

FIRST-YEAR ENROLLMENTS AND GRADUATES IN VETERINARY SCHOOLS UNDER BASIC AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1970-71 AND 1971-72; PROJECTED 1972-73 THROUGH 1989-90

Academic year	First-year enrollment			Graduates		
	Basic methodology	Alternative assumptions		Basic methodology	Alternative assumptions	
		Low	High		Low	High
1970-71	1,432	1,432	1,432	1,239	1,239	1,239
1971-72	1,453	1,453	1,453	1,252	1,252	1,252
1972-73	1,575	1,575	1,575	1,266	1,266	1,266
1973-74	1,657	1,657	1,657	1,381	1,381	1,381
1974-75	1,695	1,695	1,695	1,412	1,412	1,412
1975-76	1,726	1,695	1,746	1,465	1,465	1,465
1976-77	1,757	1,695	1,798	1,541	1,541	1,541
1977-78	1,789	1,695	1,852	1,576	1,576	1,576
1978-79	1,821	1,695	1,908	1,605	1,576	1,610
1979-80	1,854	1,695	1,965	1,634	1,576	1,659
1980-81	1,887	1,695	2,024	1,664	1,576	1,708
1981-82	1,921	1,695	2,085	1,694	1,576	1,759
1982-83	1,956	1,695	2,148	1,724	1,576	1,813
1983-84	1,991	1,695	2,212	1,755	1,576	1,867
1984-85	2,027	1,695	2,278	1,787	1,576	1,923
1985-86	2,063	1,695	2,346	1,819	1,576	1,981
1986-87	2,100	1,695	2,416	1,852	1,576	2,041
1987-88	–	–	–	1,885	1,576	2,101
1988-89	–	–	–	1,919	1,576	2,164
1989-90	–	–	–	1,953	1,576	2,229

Source: 1970-71 through 1972-73 first-year enrollments: Applications for capitation grants submitted to BHRD.
1970-71 through 1974-75 graduates: Applications for capitation grants submitted to BHRD.

Under the basic assumption outlined earlier, the supply of active veterinarians is projected to grow from 25,900 in 1970 to 36,400 in 1980 and to 48,100 in 1990, as shown in Table 81. The growth in active veterinarians is thus projected at 10,500 between 1970 and 1980 compared with a 6,200 increase between 1960 and 1970. This is a somewhat larger percentage increase than that experienced in 1960 to 1970—41 percent as compared with 31 percent. Between 1980 and 1990, growth is projected to be less rapid—a 11,700 increase, or 32 percent. The ratio of active veterinarians to population, which rose between 1960 and 1970, is projected to continue to rise sharply. The ratio is projected to reach 16 per 100,000 population in 1980 and 19 per 100,000 in 1990, as compared with a ratio of 13 in 1970.

Under the high alternative projection, the supply of active veterinarians is projected to increase to 36,400 in 1980 and 49,600 in 1990. Under the low alternative, the supply of active veterinarians is projected to be 36,300 in 1980 and 45,700 in 1990. The supply projection of active veterinarians in 1990 under the basic assumption thus yields a supply that is 2,400 more than the low estimate, and 1,500 fewer than the high estimate. The low alternative yields a population ratio of 18 veterinarians per 100,000 in 1990, compared with 20 per 100,000 in the high estimate and 19 per 100,000 under the basic assumption.

Table 81.

SUPPLY OF ACTIVE VETERINARIANS AND VETERINARIAN/POPULATION RATIOS, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 AND 1970; PROJECTED 1975-90

Projection series	1960	1970	1975	1980	1985	1990
	Number of active veterinarians					
Basic methodology	19,700	25,900	30,700	36,400	41,100	48,100
Alternatives:						
Low	19,700	25,900	30,700	36,300	41,300	45,700
High	19,700	25,900	30,700	36,400	42,600	49,600
	Rate per 100,000 population[1]					
Basic methodology	10.9	12.7	14.3	16.0	17.6	19.2
Alternatives:						
Low	10.9	12.7	14.3	16.0	17.3	18.2
High	10.9	12.7	14.3	16.0	17.8	19.8

[1] Resident population as of July 1 for 50 States and the District of Columbia.

Source: 1960 and 1970 active veterinarians: Based on data from the American Veterinary Medical Association.
Population: U.S. Bureau of the Census. *Current Population Reports*, Series P-25, Nos. 468, 477, and 483.

Chapter 10 • REGISTERED NURSES

This chapter presents data on active registered nurses in the 50 States and the District of Columbia; registered nurses who may be overseas or in the territories are excluded. Historical data cover all registered nurses in practice, including both Federal and non-Federal personnel, although data prior to 1960 exclude Alaska and Hawaii.

Biennial national estimates of active registered nurses have been developed by the Interagency Conference on Nursing Statistics for 1954 and 1965, based largely on counts made by the employers of nurses (in contrast to the self-enumeration questionnaire method of the periodic inventories[1]. When it became evident that annual estimates were needed for planning purposes, the Conference agreed to make such estimates by subtracting net attrition from, and adding new graduates to, the previous year's supply. Following release of data[2] from national inventories and from current surveys of the various fields of nursing, the current estimates are reexamined, differences analyzed, and adjustments made if necessary. The full-time and part-time components of the nursing supply are based on the results of hospital nursing surveys[3], public health nursing counts[4], nurse-faculty census reports[5], State surveys[6], and special studies. The Interagency Conference estimates refer to January 1 of each year, but for purposes of this report, the reference date is noted as December 31 of the previous year; e.g., January 1, 1972 = December 31, 1971.

Data on age distribution and distribution by location of active registered nurses were obtained directly from the 1966 Inventory of Registered Nurses. These distributions were not applied to the 1970 total estimate of registered nurses. To derive the 1970 estimate of fields of employment, the percent distributions of nurses in private duty, office, and occupational health fields obtained from the 1966 inventory of registered nurses were applied to the 1970 estimate of active registered nurses as obtained from the Interagency Conference. Other field-of-employment categories were estimated from employer counts. Although some differences undoubtedly exist between the patterns of location and employment of newly registered nurses (1966-70) and those registered in earlier years, no data are available specifically on patterns of location and employment of registered nurses entering the labor force since 1966.

The Division of Nursing, Bureau of Health Resources Development, has contracted with the American Nurses, Association to conduct a current inventory of registered nurses in conjunction with the license renewal procedure. However, since licensure renewal dates cover a 2-year period, data from the inventory are not expected to be available until late 1974. Proposed contracts to develop a nurse manpower data collection capability for Puerto Rico, Virgin Islands, and Guam are expected to produce reliable baseline data from which estimates and projections can be made by 1975. Furthermore, a number of projects are being developed to explore ways of improving the current data base for R.N.'s.

CURRENT CHARACTERISTICS AND TRENDS

In 1970, there were approximately 723,000 registered nurses actively engaged in practice in the United States. According to the 1966 Inventory nearly one-half of all R.N.'s were under 40 years of age, and 15 percent 55 years of age and older. The median age in 1966 was 40.3 years. (See Table 82.)

According to the 1966 Inventory, only about 7,000 active registered nurses, or 1 percent of the total, were men. However, recent increases in enrollment of males in initial programs of nursing suggest that this proportion is expected to rise somewhat in the future. The National League for Nursing reports that in academic year 1971-72, 5.5 percent of admissions in programs of registered nursing were men.[7]

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[1] U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Professions Education and Manpower Training; Division of Nursing. *Health Manpower Source Book 2. Nursing Personnel.* Public Health Service Pub. No. 263, Section 2. U.S. Government Printing Office, revised 1969.

[2] American Nurses' Association. *RN's 1966. An Inventory of Registered Nurses.* New York, The Association, 1969.

[3] U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Professions and Manpower Training; Division of Nursing. *Nursing Personnel in Hospitals - 1968.* U.S. Government Printing Office, May 1970.

[4] U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Professions and Manpower Training; Division of Nursing. *Nurses in Public Health.* Public Health Service Pub. No. 785. U.S. Government Printing Office, revised 1969.

[5] National League for Nursing. *Nurse-Faculty Census.* New York, The League, 1970. Biennial editions.

[6] U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Manpower Education; *Planning for Nursing Needs and Resources.* DHEW Pub. No. (NIH) 72-87. U.S. Government Printing Office, 1972.

[7] American Nurses' Association. *Facts About Nursing, A Statistical Summary.* 1970-71 edition. New York, The Association.

Table 82.

PERCENT DISTRIBUTION OF ACTIVE REGISTERED NURSES BY SEX AND BY AGE GROUP: 1966

Sex and age group	Percent distribution
Both sexes	100.0
Male	1.1
Female	98.9
All ages	100.0
Less than 25 years	11.0
25-44 years	49.3
25-29	14.5
30-34	11.4
35-39	10.8
40-44	12.6
45-64 years	33.5
45-49	10.9
50-54	9.4
55-59	8.4
60-64	4.8
65 years and over	3.1
Not reported	3.1

Source: American Nurses' Association. *RN's 1966. An Inventory of Registered Nurses.* New York, The Association, 1969.

Blacks comprised less than 6 percent of employed professional nurses in 1960, according to the 1960 Census of Population.[8] As Blacks accounted for only 7.5 percent of the admissions in initial programs of nursing in 1971-72 and only slightly more than 5 percent of nursing graduates in that year, it is not believed that the proportion of Blacks in the nursing profession has changed significantly since 1960.[9]

In 1966 the inventory showed that registered nurses were disproportionately located in the New England and Middle Atlantic divisions which had ratios of 509 and 395 respectively. The lowest ratio (176 per 100,000) was found in the East South Central division. Among individual States, registered nurse/population ratios ranged from a high of 536 per 100,000 population in Connecticut to a low of 133 per 100,000 population in Arkansas. (See Table 83.)

In 1970, it was estimated that over 500,000 registered nurses, or 7 out of every 10, were employed in hospitals, nursing homes, and related institutions, as shown in Table 84. Seven percent were in public health, 4 percent in nursing education, and 3 percent were in occupational health. Approximately 113,000 nurses, or nearly 16 percent of the total, were in private duty, office nursing, or fields of employment not separately identified.

Over the last two decades, the number of active registered nurses increased by more than 90 percent, from 401,600 in December 1953 to 777,000 in December 1972. The growth in registered nurses was substantially faster than the population growth, and the ratio of active registered nurses to population rose from 250 to 372 per 100,000 population in that period. (See Table 85.)

During the 1960's, enrollments in initial programs of nursing increased sharply, corresponding to the growth in active registered nurses during the period. As shown in Table 86, total enrollment increased from 118,800 in 1960-61 to 213,100 in 1972-73, or by 79 percent. The number of graduates increased by more than 70 percent during this period, from 30,300 in 1961 to 51,800 in 1972.

PROJECTIONS OF THE SUPPLY OF REGISTERED NURSES TO 1990

Three projections of the supply of active registered nurses (R.N.'s) are presented here, using different assumptions relating to graduate input over the projection period as well as some variation in the techniques utilized. Two major variables were used for these projections: (1) the numbers of new graduates from U.S. nursing schools which prepare students for licensing examinations (includes 50 States and the District of Columbia for purposes of these projections); and (2) withdrawal rates from the profession. It should be noted that a few terms used in the remainder of this chapter may differ in meaning from those found in other chapters of this report. Specifically, attrition of nursing students is described in terms of "completion rates," and separation rates are described in terms of "withdrawal and net attrition rates".

The numbers of graduates from initial nursing programs for academic years 1970-71 and 1971-72 were obtained from the National League for Nursing's annual survey of nursing schools.[10] Estimates of graduates from diploma programs for 1972-73 and from baccalaureate programs for 1972-73 and 1973-74 were derived from prior admissions reported in the annual surveys, utilizing completion rates specific to each program.

[8] U.S. Bureau of the Census. *United States Census of Population: 1960. Detailed Characteristics. United States Summary.* Final Report PC(1)-1D. U.S. Government Printing Office, 1963.

[9] *Facts About Nursing, op. cit.*

[10] National League for Nursing. *State-Approved Schools of Nursing—RN, 1973.* New York, The League, 1973.

Table 83.

NUMBER OF EMPLOYED REGISTERED NURSES AND NURSE/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: 1966

Division and State	Number of employed registered nurses[1]	Resident population July 1, 1966 (in 1,000's)	Rate per 100,000 population
UNITED STATES	613,188	195,936	313
NEW ENGLAND	57,262	11,244	509
Connecticut	15,438	2,878	536
Maine	4,051	978	414
Massachusetts	28,743	5,403	532
New Hampshire	3,521	676	521
Rhode Island	3,673	898	409
Vermont	1,836	411	447
MIDDLE ATLANTIC	145,031	36,705	395
New Jersey	24,942	6,899	362
New York	74,280	18,205	408
Pennsylvania	45,809	11,601	395
SOUTH ATLANTIC	78,450	29,105	270
Delaware	2,098	513	409
District of Columbia	3,662	806	454
Florida	21,760	5,893	369
Georgia	6,956	4,445	156
Maryland	10,005	3,611	277
North Carolina	12,126	4,974	244
South Carolina	5,625	2,589	217
Virginia	11,511	4,465	258
West Virginia	4,707	1,809	260
EAST SOUTH CENTRAL	22,634	12,894	176
Alabama	5,912	3,511	168
Kentucky	6,297	3,181	198
Mississippi	3,670	2,337	157
Tennessee	6,755	3,866	175
WEST SOUTH CENTRAL	34,184	18,795	182
Arkansas	2,609	1,956	133
Louisiana	6,758	3,617	187
Oklahoma	4,650	2,477	188
Texas	20,167	10,747	188
EAST NORTH CENTRAL	118,555	38,736	306
Illinois	35,552	10,786	330
Indiana	12,829	4,951	259
Michigan	23,441	8,468	277
Ohio	32,649	10,364	315
Wisconsin	14,084	4,167	338
WEST NORTH CENTRAL	51,541	15,933	323
Iowa	9,981	2,760	362
Kansas	6,895	2,275	303
Minnesota	14,441	3,572	404
Missouri	11,291	4,564	247

See footnote at end of table.

Table 83.

NUMBER OF EMPLOYED REGISTERED NURSES AND NURSE/POPULATION RATIOS, BY GEOGRAPHIC DIVISION AND STATE: 1966—Continued

Division and State	Number of employed registered nurses[1]	Resident population July 1, 1966 (in 1,000's)	Rate per 100,000 population
WEST NORTH CENTRAL—Continued			
Nebraska	4,730	1,439	329
North Dakota	2,114	643	329
South Dakota	2,089	679	308
MOUNTAIN	25,738	7,717	334
Arizona	5,862	1,603	366
Colorado	8,312	1,955	425
Idaho	1,954	697	280
Montana	2,483	702	354
Nevada	1,060	431	246
New Mexico	2,511	1,002	250
Utah	2,347	1,007	233
Wyoming	1,209	319	379
PACIFIC	79,793	24,807	323
Alaska	590	265	223
California	58,694	18,802	312
Hawaii	2,334	727	321
Oregon	6,814	1,973	345
Washington	11,361	3,040	374

[1] Adjusted for nonresponse.

Source: Employed registered nurses: American Nurses' Association. *RN's 1966. An Inventory of Registered Nurses.* New York, The Association, 1969.
Population: U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 380.

Note: Figures may not add to totals and subtotals due to independent rounding.

The withdrawal rate from the profession (or the annual net separation-attrition rate) represents a combination of gains and losses to the supply in one figure. The rate accounts for losses during the year due to resignation, retirements, death, or inactive status, as well as gains through the return to practice of nurses formerly inactive and through the addition of foreign-educated nurses licensed in this country by endorsement. Reported as "inactive" are those R.N.'s who are continuing their education on a full-time basis. The numbers of foreign-educated nurses working in this country (a gain included in the net attrition rate) could be estimated from the numbers of new licenses issued where individual States do not require all applicants to pass the State Board examination. This group represents only about 4 percent of the total active R.N. supply. It should be noted, however, that more

Table 84.

NUMBER OF ACTIVE REGISTERED NURSES, BY FIELD OF EMPLOYMENT: DECEMBER 31, 1970

Field of employment	Number of active registered nurses	Percent distribution
All fields	723,000	100.0
Hospital, nursing home, and related institution	506,000	70.0
Public health (including school)	53,000	7.3
Nursing education	31,000	4.3
Occupational health	20,000	2.8
Private duty, office nurse, and other	113,000	15.6

Source: BHRD, Division of Nursing.

Table 85.

TREND IN NUMBER OF ACTIVE REGISTERED NURSES AND NURSE/POPULATION RATIOS: SELECTED YEARS DECEMBER 31, 1953-72

Year	Number of active registered nurses	Resident population (in 1,000's)	Active registered nurses per 100,000 population
1953[1]	401,600	160,492	250
1955[1]	430,000	166,725	258
1957[1]	460,000	172,809	266
1959	504,000	178,729	282
1961	550,000	184,480	298
1963	582,000	189,922	306
1965	621,000	194,578	319
1966	640,000	196,516	326
1967	659,000	198,492	332
1968	680,000	200,415	339
1969	700,000	202,617	345
1970	723,000	205,056	353
1971	748,000	207,336	361
1972	777,000	209,123	372

[1] Excludes Alaska and Hawaii.

Source: 1953-70 active registered nurses: American Nurses' Association. *Facts About Nursing. A Statistical Summary*. 1970-71 edition. New York, The Association, 1971.
1971, 1972 active registered nurses: BHRD, Division of Nursing.
Population: U.S. Bureau of the Census. *Current Population Reports*. Series P-25, Nos. 465, 475, and 509.

and more States are requiring the examination, which may account for some of the decrease in numbers of licenses issued by endorsement of a certificate from a foreign country.

In this report, the net annual attrition rate is computed at intervals from actual supply figures at two points in time, according to a formula developed by Dr. Nathan Jaspen.[11] In a 1968 article, Folk and Yett discuss this formula and also compare the results of applying various projection methods to the fields of engineering and nursing.[12]

Between 1950 and 1956, the estimated net attrition rate was approximately 5 percent.[13] In the next 4 years, when the supply estimates included groups of R.N.'s not counted before, the net attrition rate was considerably lower. Taking both rates into account, the overall net losses from active supply during 1950-60 amounted to about 4 percent a year. On the basis of data from the inventories of registered nurses in 1962 and 1966, the net attrition rate from active supply in recent years has been 3 percent.

Inactive nurses constitute a sizable proportion of those who graduated from schools preparing for practice as registered nurses. Actually there are two types of inactive nurses: those who maintain a license to practice, and those who do not. The maintenance of a license is not dependent upon employment. At the present time, a nurse can continue licensure through the payment of a renewal fee to the State issuing the license, provided that the license had not been revoked for violations. While no information is available on the inactive nurses who do not maintain licenses to practice, data are available on those who do maintain licenses, when inventories of registered nurses are conducted. However, when considering the inactive nurse as a potential source of supply, it may not be remiss to look at the latter group as they have indicated retaining an interest in nursing through the maintenance of a license.

The 1966 Inventory of Registered Nurses estimated that about 296,000 of the nurses holding current licenses to practice at the time of the study were not employed in

[11] Meyer, Burton. Development of a Method for Determining Estimates of Professional Nurse Needs. *Nursing Research* 6: 24-28, June 1957.
[12] Folk, Hugh and Yett, Donald E. Methods of Estimating Occupational Attrition. *Western Economic Journal* VI: 297-302, September 1968.
[13] Meyer, Burton, *op. cit.*

Table 86.

TREND IN NUMBER OF PROGRAMS, ENROLLMENTS, ADMISSIONS, AND GRADUATES FOR REGISTERED NURSING SCHOOLS: ACADEMIC YEARS 1960-61 THROUGH 1972-73

Academic year[1]	Number of programs	Total enrollment	Admissions	Graduates
September 1 - August 31				
1960-61	1,137	118,849	49,487	30,267
1961-62	1,126	123,012	49,805	31,186
1962-63	1,136	123,861	49,521	32,398
1963-64	1,148	124,744	52,667	35,259
1964-65	1,158	129,269	57,604	34,686
1965-66	1,193	135,702	60,701	35,125
1966-67	1,225	139,070	58,700	38,237
1967-68	1,269	141,948	61,389	41,555
1968-69	1,293	145,588	64,157	42,196
1969-70	1,339	150,795	70,428	43,639
August 1 - July 31				
1970-71	1,355	164,545	79,282	47,001
1971-72	1,363	187,551	94,154	51,784
1972-73	1,377	213,127	N.A.	N.A.

[1] Programs and total student enrollments are counted as of October 15; admissions (first year enrollments) and graduations are for the academic years as noted. Change in the academic year reporting dates resulted in overlapping counts of admissions and graduations during the transition period so that the 1970-71 figures for these items are not comparable to the figures for prior years. Numbers of programs and total enrollments are not affected by the change. Data include 50 States, District of Columbia, Guam, Puerto Rico, and the Virgin Islands.

Source: National League for Nursing. *State-Approved Schools of Nursing - R.N. 1973.* New York, The League, 1973. Also prior annual editions.

nursing.[14] They represented almost a third of the total supply of registered nurses. Almost 87 percent of these inactive nurses were married and more than 50 percent were under the age of 40. Of course, there were a number of the inactive nurses who were from older segments of the population; about 17 percent were at least 55 years old. Nevertheless, the presence of a large group of relatively young married women, would suggest that a segment of these inactive nurses may intend to return to work.

The inventories do not include data on the job-related intentions of the inactive nurses. However, some studies of inactive nurses conducted at the time of the 1966 Inventory provide some clues as to their intentions. The studies varied in scope and therefore could not be used for an intensive analysis. They did for the most part cover those inactive nurses who maintained licenses to practice. Some proportion of the respondents to these surveys, although less than half, indicated that they intended to return to work at some time in the future. Of those who did return to work, it was most frequently in a part-time position. These data tended to confirm the findings of a 1961 study of inactive nurses made by the Division of Nursing, BHRD. In that study, 44 percent of the respondents indicated they planned to return to active practice. Of those planning to return, the largest proportion indicated that they intended to work on a part-time basis.[15]

METHODOLOGY AND ASSUMPTIONS

Estimates of the number of active registered nurses for the 1971-90 period were calculated using the Interagency Conference on Nursing Statistics January 1, 1971 (December 31, 1970) estimate as the base. For each projected year,

[14] American Nurses' Association. *RN's 1966. An Inventory of Registered Nurses.* New York, The Association, 1969.

[15] Reese, Dorothy E.; Siegel, Stanley; and Testoff, Arthur. The Inactive Nurse. *American Journal of Nursing* 64:124-128, November 1964.

the graduates of nursing programs during the year were added to the active supply at the beginning of the year. Subtracted from this total were estimates of losses derived by applying the net attrition rate to the supply at the beginning of the year. This procedure yielded the active supply of registered nurses at the end of the year, and the cycle was then continued for all subsequent years of the projection period.

Estimates of graduates were computed by applying completion rates for each type of program (baccalaureate, diploma, associate degree) to total admissions for that program. The lag time for completion was 2 years for the associate degree program, 3 years for the diploma program, and 4 years for the baccalaureate program.

As with most other groups of health professionals, the future supply of registered nurses is largely a reflection of the course of enrollment in schools of nursing. From 1958-59 through 1971-72 the number of graduates of initial programs of nursing (R.N.) rose at an average annual growth rate of 3.9 percent. More significantly, however, the annual rate of increase averaged only 1.9 percent from 1958-59 through 1965-66 (prior to the influx of Federal support), but was 6.9 percent from 1965-66 through 1971-72. (See Table 86.) This latter spurt in enrollment in large part reflects the impact of Federal support provided through construction grants, special project grants for improvement in nurse training, institutional grants, and traineeships and other assistance to students. To illustrate the impact of the nursing legislation, the Progress Report of Nurse Training 1970[16] stated that without the assistance under provisions of the Nurse Training Act, enrollment in the Nation's nursing schools would have been about 13,200 (8.8 percent) fewer in 1969 than it actually was. Similarly, without nurse training funds, admissions in that academic year would have been 5,800, or 9 percent, less than actual admissions. Between 1965 and 1971 admissions to schools of nursing rose by an annual rate of 7 percent, compared with a 5 percent annual increase during the 1958-71 period.

For purposes of this report, the basic projection assumes that upon the expiration of current legislation, the combined level of Federal and non-Federal support would be such as to provide for the maintenance of enrollment levels resulting from earlier legislation. Given this framework, the basic methodology assumed that total admissions would increase only slightly, by 1 percent annually, from 103,100 in 1972-73, leveling off at 114,000 in 1982-83 and continuing at that level through the projection period. (See Table 87.)

In addition, under the basic methodology, it was assumed that the distribution of admissions among the three types of nursing programs would continue the trends of recent years; i.e., the proportion entering baccalaureate and associate degree programs would increase as those entering diploma programs decrease. Consequently, the assumption was made that the proportion of admissions in diploma programs would decrease from the 1972-73 proportion by 1 percent annually through the projection period, and the proportions entering baccalaureate and associate degree programs would increase by 0.7 percent and 0.3 percent a year respectively.

Recent trends indicate that the average completion (retention) rates by type of program is 65 percent for baccalaureate, 74 percent for diploma, and 65 percent for associate degree students. Under the basic methodology, graduate estimates through 1990 were derived by applying these rates to the appropriate admissions (allowing necessary lag time).

The annual net attrition rate was held constant at 3 percent annually throughout the projection period. The rationale for this rate has been discussed earlier.

Two alternative sets of assumptions were also made. First, as a low projection, it was assumed that the decrease in the proportion of admissions to diploma programs would not be as sharp as under the basic methodology. Under this alternative, it was assumed that the proportion of admissions in diploma programs as well as baccalaureate and associate degree programs would level off in the early 1980's. In this alternative, total admissions were assumed to be the same as under the basic methodology.

The low projection also assumed that the completion rates by type of program would be somewhat lower than under the basic methodology over the projection period. It was assumed that baccalaureate completion rates would level at 60 percent, while diploma and associate degree completion rates would be 73 percent and 63 percent respectively. For this alternative projection, net attrition was again held at 3 percent through the projection period.

The high alternative projection assumed that changes in total numbers of admissions to schools of nursing would reflect changes in total college enrollments over the projection period. Thus, it was assumed that the relationship of 2.4 R.N. program admissions to 100 total college enrollments established in recent years would continue at that level. College enrollment projections of the Bureau of the Census were utilized to develop projections of admissions under this alternative.[17] Assumptions as to proportion by type of program were identical to that of the low alternative projection.

[16] U.S. Department of Health, Education, and Welfare; Public Health Service. *Progress Report on Nurse Training, 1970: Report to the President and the Congress.* U.S. Government Printing Office, 1970.

[17] U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 473. (Series E-2)

Table 87.

ADMISSIONS AND GRADUATES IN SCHOOLS OF NURSING UNDER BASIC AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1970-71 AND 1971-72; PROJECTED 1972-73 THROUGH 1989-90

Academic year	Admissions[1]			Graduates[1]		
	Basic methodology	Alternative assumptions		Basic methodology	Alternative assumptions	
		Low	High[2]		Low	High[2]
1970-71	78,524	78,524	78,524	46,500	46,500	46,500
1971-72	93,344	93,344	93,344	51,304	51,304	51,304
1972-73	103,100	103,100	97,428	56,929	54,452	56,929
1973-74	104,100	104,100	101,388	61,951	59,186	60,476
1974-75	105,200	105,200	105,504	66,864	63,895	64,916
1975-76	106,200	106,200	109,764	70,077	66,348	67,789
1976-77	107,300	107,300	113,484	70,671	66,813	70,344
1977-78	108,400	108,400	116,520	71,293	67,320	72,819
1978-79	109,400	109,400	119,160	71,909	68,818	76,104
1979-80	110,500	110,500	121,500	72,518	69,453	78,156
1980-81	111,600	111,600	123,408	73,136	70,242	80,063
1981-82	112,700	112,700	124,752	73,745	70,914	81,589
1982-83	114,000	114,000	125,172	74,375	71,582	82,790
1983-84	114,000	114,000	124,812	75,060	72,376	83,632
1984-85	114,000	114,000	123,780	75,404	72,635	83,692
1985-86	114,000	114,000	122,484	75,620	72,880	83,394
1986-87	114,000	114,000	121,368	75,517	72,880	82,787
1987-88	114,000	114,000	121,116	75,415	72,880	82,029
1988-89	114,000	114,000	121,416	75,312	72,880	81,476
1989-90	–	–	–	75,209	72,880	81,257

[1] Includes baccalaureate, diploma, and associate degree programs in 50 States and District of Columbia.

[2] Admissions in the "high" series are related to total college enrollments. The numbers of admissions and graduates are not always the highest projections for a given year.

Source: 1970-71, 1971-72: National League for Nursing. *State-Approved Schools of Nursing - R.N. 1973.* New York, The League, 1973. Also 1972 edition.

As under the basic methodology, completion rates by type of programs for the high alternative were assumed to follow trends of recent years; i.e., baccalaureate and associate degree, 65 percent and diploma, 74 percent. Again, net attrition was held at 3 percent for this alternative through the projection period.

It should be noted that for all projections, graduations were derived from projected admissions using appropriate completion rates and the 2-, 3-, and 4-year lag time appropriate to the type of program.

Another projection method, not shown in this report, utilized the age-specific labor force participation rate model. Supply projections derived from stock estimates and age-specific labor force participation rates (LFPR) include numbers of graduates, survival rates, and participation rates estimated from census data on LFPR of all females. Where annual graduates and baseline supply data are the same, the basic method used in this chapter and the age-specific LFPR method yield approximately the same supply projections. Altman describes the latter method in detail.[18]

PROJECTION FINDINGS

The projections developed using the basic methodology result in a total gross graduate input of 1,388,800 over the 1971-90 period. The low alternative projects a total gross graduate input of 1,336,200, and the high alternative, 1,468,000. The high and low alternatives, consequently, produce total gross graduate inputs approximately 132,000 graduates apart.

Under the basic methodology, the supply of active registered nurses is projected to grow from 723,000 in 1970

[18] Altman, Stuart H. *Present and Future Supply of Registered Nurses.* DHEW Pub. No. (NIH) 73-134. November 1971, reprinted August 1972.

to 1,099,600 in 1980, and to 1,466,700 in 1990, as shown in Table 89. Part-time nurses are projected to grow from 29 percent of the total in December 1972 to 30 percent in December 1981 and remain at this level through the projection period. (See Table 90.)

Table 88.

TREND IN NUMBER OF ACTIVE FULL- AND PART-TIME REGISTERED NURSES: SELECTED YEARS DECEMBER 31, 1955-72

Year	Number of active registered nurses			Percent distribution		
	Total	Full time	Part time	Total	Full time	Part time
1955[1]	430,000	388,000	42,000	100.0	90.2	9.8
1957[1]	460,000	384,000	76,000	100.0	83.5	16.5
1959	504,000	414,000	90,000	100.0	82.1	17.9
1961	550,000	433,000	117,000	100.0	78.7	21.3
1963	582,000	450,000	132,000	100.0	77.3	22.7
1965	621,000	466,000	155,000	100.0	75.0	25.0
1966	640,000	474,000	166,000	100.0	74.1	25.9
1967	659,000	483,000	176,000	100.0	73.3	26.7
1968	680,000	493,000	187,000	100.0	72.5	27.5
1969	700,000	503,000	197,000	100.0	71.8	28.2
1970	723,000	515,000	208,000	100.0	71.2	28.8
1971	748,000	524,000	224,000	100.0	70.1	29.9
1972	777,000	551,000	226,000	100.0	70.9	29.1

[1] Excludes Alaska and Hawaii.

Source: 1955-70 active registered nurses: American Nurses' Association. *Facts About Nursing. A Statistical Summary*. 1970-71 edition. New York, The Association, 1971.
1971, 1972 active registered nurses: BHRD, Division of Nursing.

Table 89.

SUPPLY OF ACTIVE REGISTERED NURSES AND NURSE/POPULATION RATIOS, USING BASIC METHODOLOGY AND ALTERNATIVE ASSUMPTIONS: ACTUAL 1960 AND 1970; PROJECTED 1975-90

Projection series	1960	1970	1975	1980	1985	1990
	Number of active registered nurses					
Basic methodology	527,000	723,000	889,400	1,099,600	1,294,500	1,466,700
Alternative						
Low	527,000	723,000	881,400	1,076,100	1,261,200	1,426,200
High	527,000	723,000	886,000	1,105,500	1,337,400	1,535,300
	Rate per 100,000 population[1]					
Basic methodology	293	355	414	485	541	585
Alternative						
Low	293	355	410	474	527	569
High	293	355	412	487	559	613

[1] Resident population as of July 1.

Source: 1960 active registered nurses: BHRD, Division of Manpower Intelligence.
1970 active registered nurses: American Nurses' Association. *Facts about Nursing. A Statistical Summary*. 1970-71 edition. New York, The Association, 1971.
Population: U.S. Bureau of the Census. *Current Population Reports*, Series P-25, Nos. 468, 477, and 483.

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Table 90.

SUPPLY OF ACTIVE FULL- AND PART-TIME REGISTERED NURSES, USING BASIC METHODOLOGY ACTUAL 1970-72 AND PROJECTED 1973-90

Year	Number of active registered nurses				Percent distribution		
	Total	Full time	Part time	Full-time equivalents[1]	Total	Full time	Part time
1970	723,000	515,000	208,000	619,000	100.0	71.2	28.8
1971	748,000	524,000	224,000	639,000	100.0	70.1	29.9
1972	777,000	551,000	226,000	664,000	100.0	70.9	29.1
1973	810,300	573,700	236,600	692,000	100.0	70.8	29.2
1974	848,000	599,500	248,500	723,800	100.0	70.7	29.3
1975	889,400	627,900	261,500	758,600	100.0	70.6	29.4
1976	932,800	657,600	275,200	795,200	100.0	70.5	29.5
1977	975,500	686,800	288,700	831,200	100.0	70.4	29.6
1978	1,017,500	715,300	302,200	866,400	100.0	70.3	29.7
1979	1,058,900	743,300	315,600	901,100	100.0	70.2	29.8
1980	1,099,600	770,800	328,800	935,200	100.0	70.1	29.9
1981	1,139,800	797,900	341,900	968,800	100.0	70.0	30.0
1982	1,179,300	825,500	353,800	1,002,400	100.0	70.0	30.0
1983	1,218,300	852,800	365,500	1,035,600	100.0	70.0	30.0
1984	1,256,800	879,800	377,000	1,068,300	100.0	70.0	30.0
1985	1,294,500	906,200	388,400	1,100,400	100.0	70.0	30.0
1986	1,331,300	931,900	399,400	1,131,600	100.0	70.0	30.0
1987	1,366,900	956,800	410,100	1,161,800	100.0	70.0	30.0
1988	1,401,300	980,900	420,400	1,191,100	100.0	70.0	30.0
1989	1,434,600	1,004,200	430,400	1,219,400	100.0	70.0	30.0
1990	1,466,700	1,026,700	440,000	1,246,700	100.0	70.0	30.0

[1] Equals full-time workers plus 50 percent of part-time workers.

Source: 1970 active registered nurses: American Nurses' Association. *Facts About Nursing. A Statistical Summary*. 1970-71 edition. New York, The Association, 1971.

1971, 1972 active registered nurses: BHRD, Division of Nursing.

The growth in active registered nurses is projected at 376,600 between 1970 and 1980, substantially more than the 196,000 increase from 1960 to 1970. On a percentage basis, however, the 1970-80 increase is 52 percent greater than that which occurred between 1960 and 1970 (37 percent). In the 1980-90 period, growth is projected to be at a less rapid rate, a 367,100 (33 percent) increase.

The high alternative projection of active registered nurses in 1990 yields a supply that is 68,600, or 5 percent, more than the basic methodology projection while the low alternative yields a projection that is 40,500 or 3 percent less than that obtained using the basic methodology. Under the basic methodology, the number of registered nurses is projected to grow by 743,700 (a 103-percent increase) between 1970 and 1990. The high alternative yields an increase of 812,300 registered nurses between 1970 and 1990 while the low alternative yields an increase of 703,200 registered between these years. A population ratio of 613 registered nurses per 100,000 population in 1990 is obtained from the high alternative projection. This compares with ratios of 569 per 100,000 under the low alternative and 585 per 100,000 under the basic methodology.

ADDENDUM

Subsequent to the completion of this chapter, the Interagency Conference on Nursing Statistics (ICONS) aggregated data for all fields of employment from both special surveys and preliminary data from the 1972 Inventory to develop a revised January 1972 (December 1971) estimate of 780,000 active R.N.'s. The Conference advised that previous estimates be adjusted by using graduate figures for appropriate years and applying a new net attrition rate—the latter to be computed from the January 1972 estimate back to a date preceding the time when exceptional increases may have been noted in hospitals, public health, and nursing education, where 75 percent of R.N.'s are employed. Members also agreed that

the revised net attrition rate should be carried to January 1974 (December 1973), and that intensive reexamination of estimating mechanisms would be necessary.

Following the directives of ICONS, results were examined of the 1966-72 biennial surveys of nursing personnel in American Hospital Association registered hospitals, public health agencies (including boards of education), and schools of nursing in relation to the January 1972 total estimate and field distribution determined by the Conference. The aggregated data from the surveys indicated that the greatest numerical increases in the three fields occurred in the late 1960's, but that there was little difference in the rates of increase between 1966-68 and 1968-70. Therefore, a revised net attrition rate for the period between January 1966 and 1972 was computed, with the ICONS estimates as the end points and graduations from 1965-66 through 1970-71 as "gross gain" in the formula. The rate computed was 2.1 percent a year. Reflecting this rate, the adjusted estimated numbers of employed R.N.'s are as follows:

Year as of December 31	Employed registered nurses
1966	643,000
1967	667,000
1968	694,000
1969	722,000
1970	750,000
1971	780,000
1972	815,000

It should be noted that these adjusted estimates are actually intended for January 1 of the following year.

Given these considerations, the December 1970 supply of active R.N.'s presented earlier in this chapter and elsewhere in this report (i.e., 723,000) has now been revised upwards by 27,000 to 750,000. Revised supply projections, however, have not yet been developed.

Chapter 11 • ALLIED HEALTH OCCUPATIONS

Allied health manpower is defined broadly to include the professional, technical, and supportive workers in patient services, administration, teaching, and research who engage in activities that support, complement or supplement the functions of physicians, dentists, and registered nurses. In addition, personnel engaged in organized environmental health activities, such as environmental engineers, are included in the allied pool.

CONCEPTUAL AND STATISTICAL CONCERNS

The need for reliable statistical information on health manpower is nowhere more urgent than in occupations in the allied health field. Unfortunately, owing to the large and rapidly growing numbers and types of workers in this field and the inadequate data base, assessing current and future supply is extremely difficult. The process of building and maintaining a reliable data base has been greatly hampered by numerous problems, including the following:

1. Lack of consensus on the parameters of the allied health field and on definitions of allied health professions and occupations.
2. Lack of reliable estimates of current and past supply for allied health professions and occupations.
3. Limited information on the characteristics of workers.
4. Limited knowledge about the impact of task delegation on current and future supply estimates.
5. Extensive use of crude estimates and professional judgment in assessing the past and present situation.

Defining allied health broadly enough to accommodate both existing professions and occupations and new and emerging ones contributed major problems for data collection. First of all, it is not always clear what fields should be classified as allied health. For example, several decades ago environmental health was a public health responsibility, and the function of assuring a safe environment was largely the province of the sanitarian. Today the picture is very different, and environmentalists are now highly skilled specialists concerned with air, water, and noise pollution; solid waste management; radiation protection; and pesticide use. This results in a major dilemma as to whether environmental personnel should be viewed as a separate field of manpower in a highly industrial urban society or whether they should be considered as a part of public health or allied health. Any data collection effort which encompasses such diversity and numbers is a mammoth undertaking.

Furthermore, the proliferation of occupations has resulted in a multitude of titles and definitions utilized to describe the allied health manpower pool. To date, more than 125 health professions and occupations have been identified in allied health, with approximately 250 additional or secondary titles which imply or define relationships between one type of worker and another. However, there are serious questions as to whether there are any real functional differences between and among some of these occupational titles.

Because the allied health field is so broadly defined and has a multiplicity of titles, manpower analysts have been unable to devise a standard nomenclature or classification system, although attempts have been made. One approach has been to classify by professional or occupational title. A refinement of this approach has been to classify manpower by function; namely, the nature of the services rendered. The traditional approach of the Bureau of Health Resources Development (BHRD) has been to classify workers on the basis of appropriate basic educational preparation either at the technologist or technician level.

Unfortunately, no classification system for allied health professions and occupations is free of ambiguities. Confusion exists between titles, functional definitions, and educational preparation. For example, a physician's assistant is one who works at the physician-patient interface, to whom the physician delegates tasks. Some physician's assistant educational preparation programs, however, offer college credit, while others do not. Not all physician's assistants perform the same type of work; some are being used in primary care, while others are being trained for duties related to specialties.

The estimates of current and past manpower supply used in this report clearly reflect these problems, since they were developed through the use of numerous sources. As a result, they should be viewed strictly as rough estimates. A glossary of occupational titles and definitions for allied health manpower by major category has been prepared by the Association of Schools of Allied Health Professions, for use in a survey of health occupations educational programs in 2-year and 4-year colleges and universities. It is hoped that the various governmental agencies concerned will adapt the glossary to the labor force in surveys and related work, thus achieving greater consistency.

A number of sources were investigated to obtain the data needed, including State licensing boards, registry or certifying boards, professional organizations, national reports and surveys, and State surveys. Although these sources were helpful in generating statistics on allied health

manpower, numerous limitations and problems were encountered in all of them, particularly the problem of obtaining estimates of the total active supply vs. the total potential supply (active and inactive) for an occupation and then from these figures determining the number active who are formally trained.

Licensure records have traditionally been utilized as a major mechanism for the collection of manpower data. To date, only four allied health occupations (dental hygienist, environmental engineer, licensed practical nurse and physical therapist) are licensed in all 50 States. (See Table 91.) For only these four occupations is it possible to obtain the total number of potential workers through State licensure, and data are generally unavailable on the number active or on their detailed characteristics. Double counting may also result from the fact that an individual may be licensed in more than one State.

Another source of available data is the records maintained by certifying or registry boards. However, the nature of the certification or registry mechanism results in the exclusion of a proportion of the active pool. Requirements for registration or certification usually include a prescribed educational preparation and demonstration of a level of skill through testing. When certifying bodies are part of a professional organization, membership in the organization may also be a requirement. Thus, although useful, registries do not account for the total active supply or potential in an occupation, but yield information on only that segment of the manpower pool which at some point in time has qualified for, and has chosen to seek, registration or certification.

Problems in coverage also occur in the use of professional organizations and their membership. Again, double counting may occur. Membership totals in professional organizations cover a widely varying percent of all workers and often include both active and inactive workers. However, associations do maintain information on items such as name, age, sex, income, and education which provide useful insights into the profile or characteristics of allied health workers.

Numerous problems have also been encountered when utilizing data from the population census. First, occupational data are collected through the use of a sample and the estimates derived from the sample are influenced by sampling error, thus weakening the reliability of the estimates. Second, since the census is conducted at 10-year intervals, the value of these estimates is negligible. Finally, classification of specific occupations, while useful for some purposes, is not as detailed and accurate as required for this purpose. Occupational titles are often combined, thus eliminating information on specific detailed allied health professions and occupations.

Despite the insufficiency of the census figures for the purposes of this chapter, the data do provide an insight into the composition of the allied health labor force with regard to race and sex. Six occupations which are analyzed in this report were reported in the 1970 Census of Population:

Table 91.

NUMBER OF STATES REQUIRING LICENSING FOR ALLIED HEALTH OCCUPATIONS: 1971-72

Occupation	Number of States	Occupation	Number of States
Dental hygienist	50	Physical therapy assistant	14
Dental laboratory technician	1	Physician's assistant	1
Environmental engineer	50	Psychiatric aide	3
Licensed practical nurse	50	Psychologist	46
Medical technologist	10	Radiologic technologist	3
Midwife (lay)	23	Respiratory therapist	1
Nursing home administrator	49	Sanitarian	35
Optical technician	2	Sanitarian technician	1
Optician	17	Social worker	9
Physical therapist	50	Speech pathologist and audiologist	5

Source: Licensed practical nurses, respiratory therapists, sanitarians, and sanitarian technicians: U.S. Department of Health, Education, and Welfare. *Report on Licensure and Related Health Personnel Credentialing.* DHEW Pub. No. (HSM) 72-11. U.S. Government Printing Office, 1972.

All other occupations: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972. Also unpublished data from various associations.

dental hygienists, dental assistants, dental laboratory technicians, dietitians, licensed practical nurses, and radiologic technologists and technicians.[1] The six occupations comprise only 17 percent of the estimated total active supply of allied health manpower and do not necessarily represent a cross-section with regard to various levels of occupational skills, necessary training, and experience, factors that may greatly influence the characteristics of workers. Based on the census data for the aggregate of the six occupations for 1970, it is estimated that Blacks and persons of Spanish heritage represented 15 and 4 percent, respectively, within the six occupations. Females employed in these six occupations represented 89 percent. By race, females were most predominant among the Blacks, comprising 92 percent of this group as compared with 77 percent for workers of Spanish heritage.

Many States have conducted health manpower surveys, but most are fraught with problems related to the number of employers surveyed, format, basic method of data collection, and definitional differences. As a result, estimates are seldom comparable.

In addition to the special considerations listed above, there are a number of general factors that necessarily enter into any assessment of allied health workers. These include characteristics such as age and sex, geographic mobility, education, and working environment. Analysis of some of these factors as they affect allied health manpower has proceeded slowly owing to the limited information currently available. For example, the majority of allied health workers are women and a large proportion are young. Such workers often train and work during their teens and early twenties and retire from the labor force to raise families. Little is known about their reentry patterns—whether they return to work, at what age, and into what occupation.

Surveys dealing with the characteristics of allied health workers have, nevertheless, been attempted at both the national and State levels. At the national level, studies have been done by the Bureau of the Census and the Bureau of Labor Statistics. However, these sources differ in the manner in which occupations are classified and the data items obtained, thus creating comparability problems that preclude their extensive use in this chapter.

With respect to future data availability, numerous projects are in progress or are being developed by the staff of the Bureau of Health Resources Development (BHRD) in order to improve and expand the current data base. Such efforts are being directed towards the following projects:

1. A comprehensive survey of allied health professions and occupations in hospitals.
2. A survey of allied health professions and occupations in ambulatory care settings.
3. A survey of selected characteristics of allied health personnel employed in hospitals.
4. The development of a computer-oriented allied health manpower data base composed of data from available State surveys.

CURRENT CHARACTERISTICS AND TRENDS

In 1970, an estimated 2.7 million workers were in professions and occupations classified as allied health by BHRD. The 1970 figure represents an increase of 75 percent over 1960. The growth of this field may be attributed to a number of factors, including the greater utilization of allied health workers, increased employment opportunities resulting from the expansion of the health care delivery system, and the creation and expansion of training programs, especially at the junior college and technical education level.

The allied health field is divided into four major categories: medical, dental, environmental, and nursing allied. The medical allied health category includes such workers as personnel in medical laboratories, medical records, and medical libraries; dietetic and nutritional personnel; physical and occupational therapy personnel; radiologic personnel; and administrators. In 1970, medical allied health workers numbered 1,073,400, or 39 percent of the total. (See Table 92.)

Dental allied health workers—hygienists, assistants, and technicians—accounted for 6 percent (or 157,800) of the total allied health manpower work force in 1970. The number of workers in dental allied occupations increased 32 percent in the 1960-70 period, while the supply of dentists increased 29 percent, possibly because of greater use of these allied health personnel.

The number of environmental allied health workers in 1970 was estimated at 242,000, or 9 percent of the total. This category includes environmental scientists, engineers, technicians, and aides. Although a relatively small field, it accounted for the largest increase among the allied health categories between 1960 and 1970, doubling during that decade.

Nursing allied personnel—licensed practical nurses, nursing aides, orderlies, attendants, and home health aides—are the largest group, constituting 46 percent of the total allied health workers currently employed. Their numbers have increased sharply in recent years, virtually doubling from 681,000 in 1960 to 1,270,000 in 1970. For every active registered nurse in 1960, there were 1.3 nursing allied

[1] U.S. Bureau of the Census. *United States Census of Population: 1970. Detailed Characteristics. United States Summary.* Final Report PC(1)-D1. U.S. Government Printing Office, 1973.

Table 92.

ESTIMATED SUPPLY OF ACTIVE ALLIED HEALTH MANPOWER: 1970

Major category, profession, and occupation	Estimated active personnel
Total allied health manpower	2,743,200
Medical allied	1,073,400
Medical laboratory personnel	140,000
Clinical laboratory scientist[1]	5,000
Clinical laboratory technologist[1]	65,000
Clinical laboratory technician and assistant	70,000
Radiologic technology personnel	100,000
Radiologic technologist, technician and assistant	100,000
Medical library personnel	9,500
Medical librarian[1]	2,200
Medical library technician	7,300
Medical record personnel	53,000
Medical record administrator[1]	11,000
Medical record technician	42,000
Dietetic and nutritional personnel	47,000
Dietitian and nutritionist[1]	30,000
Dietary technician	10,000
Food service supervisor	7,000
Physical therapy personnel	24,000
Physical therapist[1]	15,000
Physical therapy assistant	9,000
Occupational therapy personnel	16,200
Occupational therapist[1]	10,700
Occupational therapy assistant and aide	5,500
Other personnel	683,700
Administrator, program representative, management officer[1]	30,000
Administrative assistant	19,000
Ward clerk	58,000
Biomedical engineer[1]	3,600
Biomedical engineering technician	7,200
Health educator[1]	23,000
Orthotist and prosthetist	3,600
Orthotic-prosthetic technician and assistant	3,600
Pharmacy assistant and aide	10,000
Clinical psychologist[1]	13,000
Research scientist[1]	51,000
Medical social worker[1]	25,200
Social work assistant	4,300
Specialized rehabilitation services	11,300
Corrective therapist[1]	1,200
Educational therapist[1]	500
Manual arts therapist[1]	900
Music therapist[1]	2,200

See footnote at end of table.

Table 92.

ESTIMATED SUPPLY OF ACTIVE ALLIED HEALTH MANPOWER: 1970–Continued

Major category, profession, and occupation	Estimated active personnel
Recreational therapist[1]	6,000
Home economist in rehabilitation[1]	500
Speech pathologist and audiologist[1]	19,000
Vision care	37,300
Optician	11,000
Ophthalmic assistant	20,000
Orthoptist	500
Optometric assistant	5,000
Optometric technician	800
Miscellaneous	364,600
Ambulance attendant	5,600
Electrocardiograph technician	9,500
Electroencephalograph technician	3,300
Respiratory therapist	11,000
Respiratory therapy assistant	3,600
Medical assistant	300,000
Operating room technician	8,000
Physician's assistant	200
Surgical and other aides	23,400
Dental allied	157,800
Dental hygienist	15,100
Dental assistant	112,000
Dental laboratory technologist	30,700
Environmental allied	242,000
Environmental engineer[1]	35,000
Environmental scientist[1]	25,000
Environmental sanitarian[1]	12,000
Environmental technician	69,000
Environmental aide	101,000
Nursing allied	1,270,000
Licensed practical nurse	400,000
Nursing aide, orderly, and attendant	848,000
Home health aide	22,000

[1] Appropriate educational preparation at least baccalaureate.

Source: Dental allied: BHRD, Division of Dental Health.
Physician's assistant: BHRD, Division of Allied Health Manpower.
All other occupations: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

workers; in 1970, in contrast, for every active registered nurse there were 1.8 nursing allied workers.

Allied health professions and occupations are also typically categorized according to their basic educational preparation: (1) at least baccalaureate preparation, and (2) less than baccalaureate preparation. In 1970, an estimated 387,000 allied health workers, or 14 percent of the total, were in the first group. Within the four major categories of allied health identified earlier, the percentage of workers for which at least baccalaureate preparation is appropriate varied from 25 to 30 percent among the environmental and medical allied health groups, to about 1 percent of the dental allied health group, and to virtually none in nursing allied.

Any discussion of the group of workers who have less than a baccalaureate preparation is difficult. The less-than-baccalaureate identification includes associate degrees, awards, and certificates, and comprises training programs in junior colleges, vocational or technical training schools, and hospitals. The programs may or may not be approved by a recognized accrediting body. The length of programs may vary from a few weeks for some occupations to several years for others. It must also be recognized that many workers are trained on the job and thus have no formal period of preparation.

PHYSICIAN'S ASSISTANTS, A RECENT DEVELOPMENT

One of the recent and more significant developments in the field of allied health has been the introduction of the formally trained physician's assistant. The distinction of formal training is the unique feature of this development, with the first educational program being initiated in 1965. The Office of Special Programs (OSP), Bureau of Health Resources Development is responsible for supporting physician's assistant training with the emphasis on the preparation of physician's assistants for primary ambulatory medical care in underserved areas. In carrying out their administrative mission the following definition of physician's assistant has been developed:

> The term physician's assistant refers to one who by training and experience is prepared to work under the supervision of a licensed physician to aid that physician in carrying out his patient-care responsibilities. The physician's assistant is prepared to collect a "data base" through a medical history, general physical examination, and routine laboratory tests; to organize the information to aid the physician in diagnosis; and to administer treatments as prescribed by the physician. He may, on the basis of standing orders, treat a defined range of medical conditions and may provide emergency care in keeping with his training and as permitted by his supervising physician. Although effective supervision is required, it need not in all cases be face-to-face. The assistant may be prepared and permitted to perform other technical or clinical tasks—laboratory, X-ray, etc.—as determined by the training program and the individual supervising physician.[2]

The Council on Medical Education of the American Medical Association (AMA), the American Academy of Family Physicians, the American Academy of Pediatrics, the American College of Physicians, and the American Society of Internal Medicine jointly developed the *Essential Requirements* which state the minimum educational requirements for the training of assistants to the primary-care physician. Essentials of an Approved Educational Program for Orthopedic Physician's Assistants and Urologic Physician's Assistants have also been developed and ratified by the AMA House of Delegates.

Although both the AMA and the OSP have worked to establish standards and descriptions for the physician's assistant educational programs and functions, the concept has not escaped the lack of clarity in nomenclature and functional activities which has been typical of most emerging occupations in allied health. For example, programs operate and educate students under a variety of titles, including those of physician's assistant, physician's associate, clinical associate, and MEDEX.

Educational programs may be differentiated by the type of physician's assistant being trained. Currently, there are 45 programs which have as their objective the training of assistants to the primary-care physician,[3] while 34 operating programs are training assistants for a specialist. In addition, the Federal Government has five training programs to prepare physician's assistants to work in the penal system, the Indian Health Service, and other settings.[4]

Several other elements tend to reflect the diversity of educational preparation. The length of training may vary from 1 to 5 years. The settings in which the educational process takes place may be a medical school, hospital, college, or university. Entrance to some programs requires only high school graduation, while others stipulate health

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[2] U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Manpower Education. *Program Support for Physician's Assistants in Primary Care.* Bethesda, Md., 1972.

[3] Information obtained from the Office of Special Programs, BHRD.

[4] American Medical Association and U.S. Department of Health, Education, and Welfare; Bureau of Health Manpower Education. *Summary of Training Programs: Physician Support Personnel.* DHEW Pub. No. (NIH) 73-318, September 1972.

care experience as a prerequisite. There are programs which will accept only applicants with a bachelor's degree. Awards vary from certificates to degrees.

The Office of Special Programs, BHRD, has compiled summary statistics on programs which educate physician's assistants for primary care. The 45 programs had graduated 363 persons by 1972, with 492 scheduled to graduate in 1973, making a cumulative total of 855 graduates by December 1973.

The American Medical Association has conducted two surveys of training programs for physician support personnel, one in 1971 and the second in 1972. The universe of programs identified by the AMA differs from the universe identified by the Office of Special Programs and the fact of nonresponse in the survey precludes comparison of the data for 1971, 1972, and 1973.

In 1972, the AMA solicited information on physician's assistants from the programs listed as operational in the June 1972 "Summary of Training Programs for Physician Support Personnel." Fifty-one program directors were requested to estimate the total number of graduates as of December 31, 1972. The names and addresses of the employers of the graduates were also requested. Fifty directors responded, and of this number 30 reported graduates. The totals, reproduced from the AMA survey findings, include physician's assistants from MEDEX programs, specialty, and primary-care physician's assistant programs, graduates, and employment status as of December 1972.[5]

Number of programs reporting graduates	30
Total estimated graduates as of December 1972	585
Employment:	
As physician's assistant	461
In office practice	236
In institution	225
As other than physician's assistant	49
Not employed	47
Status unknown	26
Deceased	2

It is of interest to compare these 1972 estimates with similar estimates collected in 1971 by the AMA. In July of 1971, 24 programs were identified as operational. Of the 20 programs which responded to the survey, 12 reported graduates. The total graduates for December 1971 were estimated to be 184. An estimated 113 were employed as physician's assistants in August of 1971. Between 1971 and 1972 the number of responding programs reporting graduates had increased one and one-half times, the number of graduates had approximately doubled, and the number employed had nearly tripled.

The growth rate in the supply of physician's assistants could only be a matter of speculation at this time. There is no reason to believe that there will not be growth, but there is also no evidence to support the assumption that the recent rate of growth will continue in the future. Much will depend on the acceptability of the physician's assistant to physicians and consumers and on the economic benefits derived.

PROJECTIONS OF THE SUPPLY OF ALLIED HEALTH PERSONNEL TO 1990

The 1970 supply estimate presented for each occupation and used as a base for the projections includes only those persons who are credentialed and are actively employed. The estimates of future entrants into allied health occupations to 1990 consider *only* graduates of approved programs. The reasons for this approach are: (1) data on the number of graduates of approved programs represent the most reliable data on educational preparation available; and (2) such an approach projects at least a prescribed minimum amount of knowledge of the subject matter in particular occupations and is assumed to be related to the estimated credentialed active base. Given the limited manpower data base for allied health professions and occupations, it was decided to develop projections focused on virtually the only "hard" data available.

Considerations which are not incorporated into the projection methodology, due to lack of quantifiable measurement, are the effects of task delegation on the number and types of the supply of future health manpower, the effect of qualified entrants into health fields as a result of equivalency and proficiency testing, and the effect of formally-trained or credentialed reentrants.

In recent years there has been increasing awareness of the ability of less-trained persons to perform competently tasks which were the function of the more highly trained. The avowed purpose in using less-trained persons is to utilize personnel more efficiently and economically and to increase services. The extent to which task delegation will affect the supply of health workers depends on several factors: the degree to which the more highly trained are willing to relinquish functions and assume new or different responsibilities; the degree to which the lesser trained are willing to assume additional responsibility; the degree to which the consumer is willing to accept the new approach; and the extent to which State laws allow for change in practice.

[5] American Medical Association, Department of Health Manpower. *1972 Survey of Operational Physician's Assistant Programs: Numbers Graduated and Employed.* Chicago, The Association, 1972.

Dentistry offers one of the best examples of past and potential effects of task delegation. For years, dental hygienists, dental assistants, and dental technicians have assisted dentists at chairside and in the laboratory. Now persons in these job categories are being trained in functions previously performed only by the dentist, while the dentist is being taught to utilize and manage this team of workers. The expanded-function auxiliary approach in dentistry may have an impact on the mix of workers offering dental services.

As stated previously, the methodology utilized to project supply in this chapter estimates a total active credentialed work force in 1970 and projects the supply through 1990 with the addition of graduates of approved programs only. This approach to estimating future supply in the field has serious limitations because of the exclusion of other entrants: those who come into the occupation from preparatory programs which are not approved; and those who come into the occupation from preparatory programs for other occupations, both approved and unapproved. Furthermore, no provision has been made for the reentrance of formally-trained workers into an occupation, owing to lack of quantifiable data on this subject. Moreover, workers in the field or entrants can become qualified through equivalency tests, which equate knowledge, experience, and skill with prescribed levels of formal training, and through proficiency tests, which match workers with jobs on the basis of measurable ability to perform. Proficiency and equivalency testing is not an entirely new concept and has been carried out in major allied health fields for several decades. However, the impetus to develop proficiency and equivalency testing for many of the allied health occupations is fairly recent, resulting from a recognition of the shortage of health manpower, a need for better utilization of existing personnel, the attempt to build career mobility into the existing health occupations, and the necessity to evaluate the competencies of existing workers to assure the quality of services being rendered. As these tests are developed and implemented, the number of credentialed active manpower could increase substantially, affecting both the number of entrants to be considered and the mix of workers within any one occupation. The mix includes those who are qualified and credentialed through formal training and/or examination; those who, although qualified, have not participated in any type of credentialing process; and those who have neither formal training nor competency demonstrated through examination.

The sections which follow provide projections to 1990 for formally trained allied health workers in 16 occupations. The occupations selected are those for which: (1) formal training of 1 year or more is predominant; (2) adequate trend data on graduates exist; and (3) reasonably reliable credentialed active and total supply estimates are available. These occupations are further divided into those which primarily require a baccalaureate and those in which less than a baccalaureate is generally required. The method of projecting supply, which proceeded through two stages for both groups, is described below.

METHODOLOGY AND ASSUMPTIONS

Appropriate Basic Occupational Preparation at least a Baccalaureate (Six Occupations). Included in this group are dietitians, medical record administrators, medical technologists, occupational therapists, physical therapists, and speech pathologists and audiologists. In the projections for this group, the estimate of credentialed active personnel in each occupation for December 1970 was obtained from *Health Resources Statistics, 1971.*[6]

The age distribution of the active 1970 credentialed supply for medical technologists[7] and occupational therapists[8] was based on survey data. For the other four occupations, an age distribution of the active work force was unavailable. It was assumed, consequently, that these four occupations were distributed by age in a manner similar to the medical technologists and occupational therapists. An average age distribution was computed from the data on medical technologists and occupational therapists and applied to the other four occupations. The sex distribution for active credentialed medical technologists and occupational therapists was also based on survey data. For the other four occupations, however, the sex distribution of the active workers in each occupation was obtained from one State study.[9]

New entrants (graduates of approved programs only) were estimated for each year of the projection period (1971-90). It was assumed that the sex distribution of the entrants for each occupation would be similar to the corresponding sex distribution for the active credentialed workers in the same occupation. The projections of new entrants were developed by first relating the number of graduates in each of the 6 occupations in 1970 (or in 1971

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[6] National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

[7] National Committee for Careers in the Medical Laboratory, Inc. Salary Survey. *GIST* No. 50, February 1972. Bethesda, Md., The Committee (newsletter).

[8] Jantzen, Alice, C. Some Characteristics of Female Occupational Therapists, 1970. *American Journal of Occupational Therapy* 26: 19-26, January 1972.

[9] Employment Security Commission of North Carolina. *Health Manpower Needs in North Carolina, 1967-1973.* Raleigh, The Commission, 1967.

where data were available) to the total number of bachelor's and first professional degrees conferred in that year.

For five of the occupations, the number of graduates from respective approved programs was computed as a proportion of total bachelor's and first professional degrees conferred for the current period. The proportion was then held constant and applied to the projected 1971-90 total degrees conferred in order to estimate future graduate additions. For speech pathologists and audiologists, the same general methodology was applied, except that the number of graduates was related to master's degrees conferred. It was assumed that the number of allied health graduates was directly related to the total pool of graduates. This methodology and assumption were supported to some extent by the limited historical data available for the 1960's.

Projected estimates of bachelor's and first professional degrees conferred through 1980 were developed by the National Center for Educational Statistics (NCES).[10] Total degree estimates for the 1981-90 period were projected by BHRD, using the same methodology used by NCES in developing the 1971-80 projections. The method assumed that the number of total bachelor's and first professional degrees conferred is related both to the total number of persons in the population and to the number of persons in the age strata who receive degrees.

Separations from the projected manpower pool were estimated annually. Separations, for the purpose of this chapter, represent separations from the occupation for all reasons, including deaths, retirements, and temporary absences. It was arbitrarily assumed for the first five occupations that, for each year during the 1971-90 period, 40 percent of the estimated graduates for that year would enter employment at age 22, 40 percent at age 23, and 20 percent at age 24; the exception was speech pathologists and audiologists, where 60 percent of the graduates were assumed to enter the field at age 23, and 40 percent at age 24. Age and sex specific separation rates for the labor force,[11] were applied to the number of active credentialed personnel (including graduates) each January 1. Estimated losses were then subtracted annually from the active pool. It was assumed that all workers would retire at 65 years of age.

APPROPRIATE BASIC OCCUPATIONAL PREPARATION LESS THAN A BACCALAUREATE (TEN OCCUPATIONS). Included in this group are cytotechnologists, dental assistants, dental hygienists, dental laboratory technicians, certified laboratory assistants, respiratory therapists, licensed practical nurses, medical record technicians, occupational therapy assistants, and radiologic technologists. In the projections for this group, the estimate of the credentialed active personnel in each occupation for December 1970 was obtained from several sources. The number of active formally trained cytotechnologists and certified laboratory assistants, as well as the number of credentialed occupational therapy assistants, represented a weighted average based on findings in three States.[12] For medical record technicians, radiologic technologists, and respiratory therapists, the number of active and credentialed workers was obtained from *Health Resources Statistics, 1971.*[13] Estimates for dental assistants and dental laboratory technicians were obtained from the Division of Dental Health, BHRD. All active dental hygienists and active practical nurses were assumed to be licensed and thus credentialed.

Age distributions for credentialed cytotechnologists and certified laboratory assistants were available from the National Committee for Careers in the Medical Laboratory (NCCML); registered radiologic technologists from organization membership files. It was assumed that these distributions would apply to the active credentialed estimate for these three occupations respectively. It was also assumed that an average of the age distribution of cytotechnologists and radiologic technologists could be applied to the remainder of the 10 occupations, except licensed practical nurses[14] and dental hygienists, for which age distributions were available.

Data on sex distributions were available for the latter two groups and for radiologic technologists. The sex distribution for dental assistants and dental laboratory technicians was available from the 1970 Census of Population. The distribution for the remaining five occupations was assumed to correspond to the sex distribution of the active work force reported in one State study.[15]

New entrants (graduates of approved programs only) were estimated for each year, 1971-90. It was assumed that the sex distribution of entrants in each occupation would be similar to the sex distribution for the active credentialed

[10] Simon, Kenneth A. and Fullam, Marie G. *Projections of Educational Statistics to 1979-80.* Office of Education Pub. No. 10030-70. U.S. Government Printing Office, 1971.

[11] Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review* 94: 49-55, June 1971.

[12] A weighted average percentage of the active credentialed vs. the non-active credentialed was computed from data in 3 State studies: 1) Unpublished data for Arizona; 2) Office of Comprehensive Health Planning. *Allied Health Manpower in Texas, 1970.* Austin, Texas, The Governor's Office, 1970; and 3) Coordinated Health Survey Committee. *Virginia Health Manpower, 1971.* Richmond, Va.: The Committee, 1971.

[13] National Center for Health Statistics, *op. cit.*

[14] Marshall, Eleanor D. and Moses, Evelyn B. *LPN's 1967: An Inventory of Licensed Practical Nurses.* U.S. Government Printing Office, 1971.

[15] Employment Security Commission of North Carolina, *op. cit.*

workers in that occupation. For graduate estimates, the number of graduates in each of the individual occupations was related to the total number of organized occupational curriculum awards, similar to the methodology used for the baccalaureate group. Trend data for total awards conferred were available for 1965-70,[16] as were trend data (1965-70) for total degree-credit enrollment in 2-year institutions; 1970-79 projections of enrollments were also available.[17] The data on enrollments were extrapolated from past trends to derive estimated total enrollment data through 1990. The proportion that awards comprised of enrollments in 1970 (23 percent) was applied to the projected estimates of total enrollment to project total awards conferred to 1990.[18]

For each of the 10 occupations, the number of graduates from the respective approved programs was computed as a percentage of the estimated total organized occupational curriculum awards conferred for the current period. The percentage was then held constant and applied to the projected 1971-90 total awards conferred to derive the graduate additions for each year. It was arbitrarily assumed that for each year, 1971-90, 40 percent of the estimated graduates for that year would enter the labor market at age 20, 40 percent at age 21, and 20 percent at age 22.

To estimate annual death and retirements, age and sex-specific separation rates for the labor force[19] were applied to the number of active credentialed personnel (including graduates) each January 1. Estimated losses were then subtracted from the active pool. It was assumed that for each occupation, with the exception of licensed practical nurses, all workers would retire by age 65. Age data available for L.P.N.'s, in contrast to the limited information obtained for the other groups, suggested an average retirement age of 70.

Limitations of Methodology. The methodology utilized in this set of projections had one purpose—to estimate, on the basis of the 1970 credentialed active supply of selected occupations, the formally trained supply of workers in these occupations through 1990 if projected entrants to the occupations represented only graduates of approved programs. The resultant figures, therefore, were not intended, nor should they be interpreted, as estimates of the total active supply for these occupations. In 1970, for example, there were a considerable number of other active workers in some of these occupations. (See Table 92.) Furthermore, there exist many other sources of personnel that can be expected to enter the occupation over the projection period—graduates of other than approved programs, graduates of diverse programs who migrate into the field, those who receive formal/informal on-the-job-training, and reentrants, among other sources. Any projection approach which includes only "appropriately trained" workers, as presented here, obviously understates the total current and future active supply.

Apart from this, however, the basic limitation of this and any other projection method is the weakness of the data available:

1. Supply estimates for the number of credentialed personnel in these occupations have been derived from a variety of sources and they reflect estimates of varying reliability. In addition, it should be noted that the assumption equating the credentialed supply with those persons formally trained cannot be supported by empirical evidence. The presumption was made that for most occupations, recent graduates of approved programs have been credentialed or qualify for credentialing, and that, except for persons coming under "grandfather clauses," most credentialed persons have received formal training. Although this presumption appeared reasonable, it must also be noted that the situation varies among occupations.
2. As indicated earlier, limited age and sex data are available for allied health professions and occupations. Assumptions advanced in this methodology concerning these characteristics, although seemingly reasonable on the surface, also cannot be supported by "hard" data. This consideration includes, where indicated, extrapolations of narrowly based survey findings to a national experience.
3. Educational data for the occupations, particularly those occupations for which personnel are trained at less than the baccalaureate level, are generally not available for a sufficient number of years to develop a meaningful time series.
4. The projections of total organized occupational curriculum awards are extremely weak.
5. The age- and sex-specific separation rates were derived from working-life tables of the general labor force. The separation rates used were based on all separations from the labor force, including deaths, retirements, and temporary absences from the occupation. It is unknown whether the separation patterns of allied health workers are similar to those of the general population. (See Appendix A.) In addition, it was assumed from available data, that workers

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[16] Hooper, Mary E. *Associate Degrees and Other Formal Awards Below the* Baccalaureate, 1969-70. DHEW Pub. No. (OE) 72-48. U.S. Government Printing Office, 1971.

[17] Simon, Kenneth A and Fullam, Marie G. *op. cit.*

[18] For each year of the 1965-70 period, the proportion of total awards to enrollments was calculated; the proportions fluctuated between 18 and 25 percent. In view of the interyear movements, the 1970 proportion was arbitrarily selected for this methodology.

[19] Fullerton, Howard N., *op. cit.*

in the allied professions and occupations covered in the projections retire at age 65 with one exception; LPN's were assumed to retire at age 70.

PROJECTION FINDINGS

In presenting the projections, it is essential to repeat the caveat that they relate only to formally trained or credentialed workers and *not* to the total active supply. Furthermore, there is considerable variation within occupations as to the proportion that is indeed credentialed, a variation that is not necessarily caused by the level of formal training required for the occupation.

Given the increased interest in training prerequisites, it is conceivable that some newly established occupations will have relatively high proportions of formally trained personnel, especially those occupations which emerge within a highly organized group, such as clinical laboratory personnel.

Although data are rather fragmentary, limited available information indicates that the credentialed work force among the 16 occupations varies not only in the size and the proportion of the total active supply they represent but in their respective sex and age distributions as well. Such compositional differences account in part for variations evidenced in projected growth rates among the groups.

Among the six occupations requiring at least a baccalaureate, for example, projected increases in the number formally trained range from over 400 percent for speech pathologists and audiologists to 46 percent for dietitians. It should be noted, once again, that such gains have been projected for the supply of the formally trained and may not be at all representative of corresponding percent increases expected for the total active supply. In fact, in most instances, it is likely that the actual growth of the total active supply will be somewhat less, since current indications suggest that the formally trained will represent a larger segment of the overall allied health work force in the coming years than is now the case.

In this regard, speech pathologists and audiologists may very well represent a case in point. As indicated in Table 93, the supply of active formally trained professionals in

Table 93.

SUPPLY OF ACTIVE FORMALLY TRAINED SELECTED ALLIED HEALTH PERSONNEL AND PERCENT CHANGE: 1970; PROJECTED 1980 AND 1990

Occupation	Number of active formally trained personnel			Percent change	
	1970	1980	1990	1970-80	1980-90
	Basic educational preparation at least baccalaureate in level				
Dietitians	15,300	18,170	22,340	18.8	23.0
Medical record administrators	4,200	5,140	6,430	22.4	25.1
Medical technologists	45,000	80,620	123,520	79.2	53.3
Occupational therapists	7,300	11,760	16,880	61.1	43.6
Physical therapists	11,550	23,030	36,570	99.4	58.8
Speech pathologists and audiologists	13,300	37,070	70,930	178.8	91.4
	Basic educational preparation less than baccalaureate in level				
Certified laboratory assistants	6,700	22,260	41,160	232.3	84.9
Cytotechnologists	2,400	4,670	7,400	94.6	58.5
Dental assistants	9,200	39,110	71,530	325.1	82.9
Dental hygienists	15,100	34,190	57,650	126.5	68.7
Dental laboratory technicians	1,600	7,070	14,290	341.9	102.2
Licensed practical nurses	400,000	565,890	819,790	41.5	44.9
Respiratory therapists	3,850	10,510	18,810	173.0	79.0
Medical record technicians	3,800	4,900	6,460	29.0	31.9
Occupational therapy assistants	600	4,360	8,820	626.7	102.3
Radiologic technologists	41,000	93,560	161,280	128.2	72.4

Source: 1970 dental allied: BHRD, Division of Dental Health
1970 all other occupations: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Note: These estimates are for the supply of formally trained personnel only, and consequently should not be viewed as representing total active supply. Additions to 1970 supply include only graduates of approved programs.

this field is projected to increase from an estimated 13,300 in 1970 to a supply of about 70,930 in 1990—a fivefold increase, with graduate inputs during the projection period representing only those workers having at least a master's degree. Assuming that the current proportion of formally trained to the total active supply (70 percent) for this occupation would remain constant over the next two decades, the total active supply of speech pathologists and audiologists would be approximately 101,300 by 1990. In light of the growing trend toward an M.A. degree as a minimum requirement for entrance into the field, however, it seems likely that the 70 percent represents a low estimate for future years. Following this logic one step further suggests that the illustrative estimate of the total active supply might indeed be on the high side.

Without question, such a discussion represents only slightly more than speculation along with insights derived from limited available data. Nonetheless, such an exercise, given projections developed here for the formally trained work force, is of use in suggesting what might constitute the maximum growth to be expected in many of the allied health professions and occupations.

One constraint to this approach, however, stems from the fact that the reliability of information on the current credentialed and total work force varies substantially among the occupations examined. The formally-trained supply of dietitians is projected to increase from 15,300 in 1970 to 22,340 in 1990, an increase of over 7,000 or 46 percent. (See Table 94.) Applying the 1970 proportion of formally-trained workers (53 percent) to the 1990 estimate of formally-trained dietitians, would result in a total active supply of slightly over 42,000 workers. The *current* data base for dietitians, however, is weak, particularly compared to that for speech pathologists and audiologists. Therefore, the projections shown, as well as the illustrative total supply possibility, must be viewed quite cautiously.

The projections show interoccupational differences in the proportion of the total active work force that is formally trained.[20] Supply estimates presented here for medical record administrators and medical technologists can be used to illustrate this point.

The projections developed for medical record administrators and shown in Table 95 suggest that it will take more than two decades for the supply of formally-trained

[20] Percentages of formally-trained personnel in the various allied occupations represent the ratios of the formally-trained, as shown in Table 93, to the total estimated supply, as shown in Table 92.

Table 94.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED DIETITIANS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained dietitians	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	15,300	1970-75	4,770	3,930
1975	16,140	1975-80	6,040	4,000
1980	18,170	1980-85	6,970	4,670
1985	20,470	1985-90	7,080	5,210
1990	22,340			

Table 95.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED MEDICAL RECORD ADMINISTRATORS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained medical record administrators	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	4,200	1970-75	1,430	1,130
1975	4,500	1975-80	1,810	1,170
1980	5,140	1980-85	2,090	1,380
1985	5,850	1985-90	2,120	1,540
1990	6,430			

workers to equal the current number active in the field. In 1970, the supply of formally-trained medical record administrators numbered 4,200, or less than two-fifths of the overall active supply (11,000). The number of formally-trained workers is projected to increase to 6,430 by 1990, or by 53 percent over the projection period.

In 1970, an estimated 69 percent of the total active supply of medical technologists (65,000) were formally trained. Between 1970 and 1990, the supply of the formally-trained segment is projected to increase from 45,000 to about 123,520, or virtually a threefold increase. (See Table 96.) Given this projection, the estimated number of formally-trained medical technologists in 1990 represents a work force that is twice the supply currently active. Stated in other terms, the projections indicate that by 1978, the supply of formally-trained personnel alone will equal the total number of medical technologists presently active.

In addition to the projections developed for these occupations, projections of the formally-trained work force were undertaken for two other allied health groups that require a minimum of a baccalaureate for entrance into the field. The supply of formally-trained occupational therapists is projected to increase from 7,300 in 1970 to 16,880 by 1990; more than doubling over the 20-year period. (See Table 97.) In 1970, the total active work force of occupational therapists (including graduates of non-approved programs, persons receiving on-the-job-training, etc.) numbered slightly less than 11,000.

For physical therapists, it is estimated that the number of formally-trained personnel will more than triple, from 11,550 in 1970 to 36,570 in 1990. (See Table 98.) The projected 1990 supply of formally-trained workers represents a work force that is approximately two and one-half times the 1970 total active supply of 15,000. Since physical therapists are now licensed in all 50 States, this 1990 projection may be relatively realistic, the majority of the active work force coming through formal training programs.

As shown in Tables 100 to 109, projections of the formally-trained supply were also developed for 10 allied health occupations which require less than a baccalaureate

Table 96.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED MEDICAL TECHNOLOGISTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained medical technologists	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	45,000	1970-75	29,610	14,450
1975	60,170	1975-80	37,460	17,010
1980	80,620	1980-85	43,270	20,880
1985	103,010	1985-90	43,960	23,450
1990	123,520			

Table 97.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED OCCUPATIONAL THERAPISTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained occupational therapists	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	7,300	1970-75	4,240	2,270
1975	9,270	1975-80	5,360	2,870
1980	11,760	1980-85	6,190	3,460
1985	14,500	1985-90	6,290	3,910
1990	16,880			

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for minimum entrance into the field. Projections, for example, were undertaken for three types of dental auxiliaries: dental hygienists, dental assistants, and dental laboratory technicians. For these occupations, however, the development and use of expanded-function auxiliaries were not considered, owing to the lack of sufficient baseline data.

The supply of formally-trained active certified laboratory assistants is projected to increase from 6,700 in 1970 to 41,160 by 1990; an increase of more than six-fold over the 20-year period. (See Table 100.) No estimate is available for the total active work force of C.L.A.'s in 1970 and therefore no projections have been made for the total occupation. Not until 1967 did the American Medical Association, the American Society of Clinical Pathologists, and the American Society of Medical Technologists jointly develop the essential requirements for certification of educational institutions to provide programs for certified laboratory assistants and initiate procedures for approval of such programs. Thus, there are very little trend data on which to base any future speculations of the proportion of the total supply who will be formally trained.

Projections were made for another type of clinical laboratory personnel, cytotechnologists. It was estimated that in 1970, 74 percent (2,400) of all active cytotechnologists were formally-trained. More than three times as many formally-trained active cytotechnologists (7,400) are projected for 1990. (See Table 101.) It is difficult to speculate what proportion this figure will represent of the total active base for cytotechnologists in 1990 for several reasons. Between 1970 and 1971 there was a 20-percent decline in the number of graduates from approved programs of cytotechnology. Employment opportunities may not expand as readily in the next two decades (possibly affecting the production of cytotechnologists) as in the last decade due to the ever-increasing technological adaptations being made in the clinical laboratory setting and the possible breakthroughs which may result from research.

Table 98.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED PHYSICAL THERAPISTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained physical therapists	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	11,550	1970-75	8,520	3,440
1975	16,640	1975-80	10,780	4,390
1980	23,030	1980-85	12,450	5,400
1985	30,080	1985-90	12,650	6,160
1990	36,570			

Table 99.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED SPEECH PATHOLOGISTS AND AUDIOLOGISTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained speech pathologists and audiologists	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	13,300	1970-75	14,840	4,580
1975	23,560	1975-80	19,960	6,450
1980	37,070	1980-85	25,150	8,490
1985	53,730	1985-90	27,620	10,420
1990	70,930			

Dental assistants, in contrast to most occupations discussed in this section, have comparatively few formally-trained personnel in the work force. In 1970, the number of formally-trained was only 9,200; or less than 10 percent of the overall active supply (112,000). The number of formally-trained dental assistants is projected to reach 71,530 by 1990. (See Table 102.) Assuming that the supply of *all* active dental assistants is totally responsive to the supply of dentists, the Division of Dental Health (BHRD) has projected the overall supply of active dental assistants to reach 170,800 by 1990. These two projections, although derived independently and by noncomparable methods, suggest that the proportion of formally-trained assistants will rise substantially over the next two decades. Such an occurrence is indeed possible, since dental assistants, who historically have been largely trained on the job, are now evidencing a marked trend toward formal training. Illustrative of this recent trend is the growth of dental assistants programs in the past decade. The number of students in dental assistant programs has risen from about 1,000, in 1962 to over 5,000 in 1970, and over 7,000 in 1972.

Since all dental hygienists practicing in the United States are licensed, a situation uncommon among allied health professions and occupations, the formally-trained base for 1970 was considered to be the same as the total active work force. In this regard, subsequently, the projections shown represent the overall active supply in the profession. As shown in Table 103, the number of active dental hygienists is projected to grow from 15,100 in 1970 to 57,650 in 1990, or an increase of 280 percent. This estimate appears to be reasonable in view of the noticeable growth in the number of programs and graduates over the past few years.

The projected supply outlook for dental laboratory technicians is quite similar to that of dental assistants. In 1970, the supply of formally-trained workers numbered about 1,600; or 5 percent of the overall active supply (30,700). This compares with a projected formally-trained

Table 100.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED CERTIFIED LABORATORY ASSISTANTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained certified laboratory assistants	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	6,700	1970-75	11,520	4,630
1975	13,590	1975-80	15,570	6,910
1980	22,260	1980-85	18,640	8,960
1985	31,950	1985-90	19,490	10,270
1990	41,160			

Table 101.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED CYTOTECHNOLOGISTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained cytotechnologists	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	2,400	1970-75	1,990	990
1975	3,400	1975-80	2,690	1,420
1980	4,670	1980-85	3,220	1,990
1985	6,090	1985-90	3,360	2,050
1990	7,400			

Table 102.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED DENTAL ASSISTANTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained dental assistants	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	9,200	1970-75	23,130	8,840
1975	23,490	1975-80	31,260	15,640
1980	39,110	1980-85	37,420	20,650
1985	55,880	1985-90	39,110	23,460
1990	71,530			

Table 103.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED DENTAL HYGIENISTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained dental hygienists	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	15,100	1970-75	16,800	8,590
1975	23,310	1975-80	22,710	11,830
1980	34,190	1980-85	27,180	15,040
1985	46,320	1985-90	28,410	17,080
1990	57,650			

supply of 14,290 by 1990 (Table 104); and an estimated 46,600 overall active supply as projected by the Division of Dental Health. Here also, the suggested increase in the proportion formally-trained may very well be reasonable, given the greater emphasis towards formal training for these workers in recent years.

The number of licensed practical nurses that are formally trained is not presently known. For the purpose of these projections, it is assumed that all L.P.N.'s are formally trained, as all are licensed. As shown in Table 105, the number of formally-trained active licensed practical nurses is projected to increase from 400,000 in 1970 to 819,790 by 1990, slightly over a 100 percent increase. This estimate appears to be somewhat conservative in light of the nearly threefold increase in the number of active L.P.N.'s between 1950 and 1970.

The projected supply outlook for formally-trained active respiratory therapists is also heavily influenced by the substantial increase in the number of approved programs and graduates in the past few years. In 1970, the supply of formally-trained workers numbered 3,850, or 35 percent of the overall active supply of 11,000. This compares with a projected formally-trained supply of 18,810 by 1990. (See Table 106.) Applying the 1970 proportion of formally-trained workers to the 1990 estimate of formally-trained respiratory therapists would result in a total active supply of almost 54,000 workers by 1990. However, the substantial increase in the number of approved programs for respiratory therapists (from 11 in 1964 to 82 in 1970) and the corresponding increase in the number of graduates (from 48 to 439 in the respective years) would indicate a trend toward formal training. This suggests that the overall active supply in 1990 may very well number less than 54,000.

Although formal training for medical record technicians was instituted in 1953, the last two decades have not

Table 104.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED DENTAL LABORATORY TECHNICIANS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained dental laboratory technicians	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	1,600	1970-75	2,610	250
1975	3,970	1975-80	3,530	430
1980	7,070	1980-85	4,230	630
1985	10,670	1985-90	4,420	790
1990	14,290			

Table 105.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED LICENSED PRACTICAL NURSES: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained licensed practical nurses	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	400,000	1970-75	236,600	171,920
1975	464,680	1975-80	319,730	218,520
1980	565,890	1980-85	382,800	255,270
1985	693,420	1985-90	400,140	273,770
1990	819,790			

Table 106.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED RESPIRATORY THERAPISTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained respiratory therapists	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	3,850	1970-75	4,390	1,440
1975	6,800	1975-80	5,930	2,220
1980	10,510	1980-85	7,100	2,890
1985	17,720	1985-90	7,420	3,330
1990	18,810			

witnessed a sizeable growth in the number of credentialed workers in this occupation. It is estimated that in 1970, for example, approximately 9 percent (3,800) of the 42,000 active supply were classified as A.R.T.'s, accredited record technicians. A 70 percent increase of formally-trained workers is projected for 1990 (6,460). (See Table 107.) This figure might represent less than 10 percent of the total active supply in 1990, since undoubtedly the supply over the next two decades will be expanded by a considerable number of workers who have not received formal training.

Although data are rather fragmentary relating to the supply of formally-trained occupational therapy assistants, projections based on the limited available information indicated that the credentialed supply of employed O.T.A.'s is to increase from 600 in 1970 to 8,820 in 1990, approximately a 15-fold increase. (See Table 108.) Assuming that the current proportion of formally-trained to the total active supply (25 percent) for this occupation would remain constant over the next two decades, the total supply of O.T.A.'s would be approximately 36,740 by 1990. However, it is likely that the actual growth of the total active supply will be somewhat less, since current indications suggest that the formally-trained will represent a larger segment of the overall work force in the coming years than is now the case.

The last occupation considered that requires an education at less than the baccalaureate level is radiologic technology. The number of formally-trained active workers is estimated at 41,000 in 1970, or 55 percent of the 75,000 estimated total active supply. The projected number of formally-trained radiologic technologists was estimated to be 161,280 by 1990, approximately a fourfold increase over the projection period. (See Table 109.) This formally-trained estimate for 1990 is approximately 2.2 times larger than the total active figure for 1970. The estimated number active in 1990, when the same ratio of formally-trained to total active in 1970 is applied, would be approximately 295,000. Such a large number is not anticipated owing to the belief that the proportion of formally-trained radiologic technologists to the total active will increase over the

Table 107.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED MEDICAL RECORD TECHNICIANS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained medical record technicians	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	3,800	1970-75	1,580	1,220
1975	4,160	1975-80	2,130	1,390
1980	4,900	1980-85	2,550	1,730
1985	5,720	1985-90	2,660	1,920
1990	6,460			

Table 108.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED OCCUPATIONAL THERAPY ASSISTANTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained occupational therapy assistants	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	600	1970-75	2,230	510
1975	2,320	1975-80	3,010	980
1980	4,360	1980-85	3,600	1,340
1985	6,620	1985-90	3,770	1,570
1990	8,820			

Table 109.

ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE FORMALLY-TRAINED RADIOLOGIC TECHNOLOGISTS: 1970 AND PROJECTED 1975-90

Year	Number of active formally-trained radiologic technologists	Interval	Additions from graduates of approved programs	Losses from deaths and retirements
1970	41,000	1970-75	38,770	16,400
1975	63,570	1975-80	52,650	22,670
1980	93,560	1980-85	63,020	28,810
1985	127,770	1985-90	65,880	32,370
1990	161,280			

20-year period. It should be noted, however, that the number of programs in radiologic technology decreased slightly over the 1970-72 period. This decrease is not reflected in the graduate output at present but may be at a later date.

The formally-trained active supply for which projections are shown represent only a portion of the total active work force, present and projected, for most of the 16 occupations. Furthermore, the 16 occupations should not be considered representative of all allied health professions and occupations for two reasons. First, the variability in the percent formally-trained and the projected differences in rate of increase for each occupation might differ from other occupations. Second, although occupations were discussed which cut across the various types of services and skills, e.g., therapists, clinical laboratory assistants, and medical record technicians—this group of 16 should in no way be considered a cross-section of the total allied health field. Again, it is stated that these projections should be interpreted cautiously, given the conceptual framework, data limitations, and assumptions made. The projections represent estimates of the formally-trained work force when only graduates of approved programs are considered.

APPENDICES

Appendix A

DERIVATION OF SEPARATION ESTIMATES (DEATHS AND RETIREMENTS) IN SUPPLY PROJECTION METHODOLOGY

The estimation of projected losses to health professions through deaths and retirements represents an important aspect of the development of supply projections. As indicated in the text, however, information on separation patterns relating specifically to health occupations is rather limited. As a consequence, for most occupations for which projections are presented here, estimates of deaths and retirements have been computed utilizing age-specific separation rates for the general working population as an initial input, with adjustments for specific occupational groups made where supportive empirical evidence exists.

The purpose of this Appendix is to discuss these techniques in greater detail than was presented earlier. In particular, the focus of the following discussion centers on the methodology used to estimate M.D. losses, given the existence of several important studies that provide useful information on the mortality and retirement experience of physicians.

OVERVIEW

The Bureau of Labor Statistics (BLS) has on a number of occasions published age-specific separation rates for the general male working population. These "working-life tables" provide estimates, for each 5-year age cohort, of the number of persons per 1,000 workers who are expected to die or retire annually.[1] These age-specific rates have been developed for the general working population, however, and not for specific occupations, of which many may have mortality and retirement experiences different from those of the general population. In the case of physicians, for example, there is independent evidence that these professionals have somewhat longer life spans than the general working population and a somewhat longer working life. Hence, estimates of M.D. deaths and retirements derived from working-life tables for the general work force would tend to overstate losses to the profession.

In this report, M.D. losses were estimated by adjusting the generalized separation rates to reflect more closely the physician experience. This adjustment was separately applied to death and to retirement rates. The resultant modified rates for each age cohort were then aggregated to develop the occupation-specific separation rates.[2]

ADJUSTMENT TO DEATH RATES

Although a number of studies have been conducted on the subject of physician mortality, the findings of which are relatively consistent, most are concerned with the total, rather than the working, M.D. population. This posed difficulties in the development of quantifiable assumptions about death rates for the *active* M.D. population, despite the fact that several of the studies suggested that "physicians have a longer life span than white males in general."[3]

A further investigation of the literature in this area uncovered a table of working life for physicians in 1959 (based on AMA data), as well as a brief summary of a comparison between that table and a similar table for U.S. males in 1960. The comparison indicated, for example, that for ages 30 through 70, "the life expectancy of physicians at any age was up to 2 years longer than that for U.S. males."[4] Overall, the comparison suggested about a 3-year difference in average life expectancy from birth.

Given this information and constraints posed by available life tables, it was assumed that physicians have an average life expectancy from birth of about 2½ years more than the average male population.[5] Life tables were

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[1] Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review* 94: 49-55, June 1971. A number of rates shown in article are in error; see Table A1 for author's suggested corrections.

[2] Separation rates developed by this method are designed to be applied to a *working*, rather than a *total* population. This method would be roughly equivalent to applying death rates to a total population and then applying an "active/total ratio" to the estimated survivors.

[3] Williams, S. V.; Munford, R. S.; Colton, T.; Murphy, D. A.; and Poskanzer, D. C. Mortality Among Physicians: A Cohort Study. *Journal of Chronic Diseases* 24: 393-401, June 1971; see also: Emerson, H. and Hughes, H. E. Death Rates of Male White Physicians in the United States by Age and Cause. *American Journal of Public Health* 16: 1088-1093, November 1926; and King, Haitung, Health in the Medical and Other Learned Professions. *Journal of Chronic Diseases* 23: 257-281, April 1970. For some evidence to the contrary, see: Dublin, L. I. and Spiegelman, M. The Longevity and Mortality of American Physicians, 1938-1942. *Journal of the American Medical Association* 134: 1211-1215, August 9, 1947.

[4] Li, F.P. Working-Life Span of Physicians. *Journal of the American Medical Association* 206: 1308, November 4, 1968.

[5] The exact difference in average life expectancy used in this method, 2.533 years, was in part chosen because of the availability of published model life tables using this difference. See: Coale, A. J. and Dement, P. *Regional Model Life Tables and Stable Populations.* Princeton, N.J., Princeton University Press, 1966.

available that provided mortality rates for populations having different average life expectancies—the two populations examined having average life expectancies of 66.023 years (approximating the 66.6 years for all U.S. males), and 68.556 years (assumed to be representative of the physician population; 2½ years longer than the U.S. male average). In line with the methodology referred to earlier, ratios of age-specific death rates obtained from these life tables were then applied to the BLS annual death rates for all working males. The resulting series was used in this report for estimating M.D. losses due to death. (See Table A-1.)

For other occupations in which age-specific separation rates were used—optometrists, pharmacists, veterinarians, and podiatrists—the basis was the generalized labor force death rates. For the allied health professions and occupations, age- and sex-specific generalized labor force deaths rates were used. A brief literature search uncovered no empirical evidence for these groups that suggested longer life spans than for the general population. It should be noted, however, that to the extent that life expectancies of workers in these occupations may indeed be longer than the national averages, the use of these generalized BLS rates may overstate losses to the professions incurred through death.

ADJUSTMENT OF RETIREMENT RATES

Empirical evidence suggests strongly that a number of health professional groups have a longer working life than that experienced by the general working population. For physicians, for example, a 1949 study of the number of "fully retired" M.D.'s revealed that approximately 64 percent of the physicians 65 years old and over worked at least several hours a week.[6] Of the surveyed M.D.'s in this age group, furthermore, the average (mean) weekly hours worked in private practice was approximately 25. Supporting this evidence, 1967 AMA data indicate that approximately 73 percent of M.D.'s in this 65-and over age group were classified as "active" (old classification system), and that slightly more than three-fifths of this age group worked a minimum of 20 hours a week.[7] In contrast, data available on labor force participation rates of all males aged 65 years old and over (1970) show only 27 percent in the labor force. Although these two data sets are not totally comparable conceptually, the evidence clearly illustrates the tendency for physicians to work longer years than the average male worker in the labor force.

A comparison was also made between age-specific labor force participation rates of the total male noninstitutional population and the proportions of M.D.'s active in corresponding age groups. For analytical purposes, a further analysis was made of the inverse of these rates; that is, the "proportion inactive" in each age cohort. As in the methodology described earlier for adjusting death rates (abridging life tables by reference to a standard table), the ratios of age-specific inactive proportions were applied to the BLS retirement rates for all working males. The resulting series was used in this report for estimating M.D. losses due to retirements. (See Table A-1.)

An identical methodology was utilized to develop an adjusted age-specific retirement series for optometrists, podiatrists, and veterinarians. For each group, reliable survey data were available that indicated a longer working life for these professionals than for the overall male labor force. For pharmacists, however, the BLS age-specific retirement rates were used with slight modification.[8] For allied health professions and occupations, the BLS retirement series was used without modification, primarily because a lack of data precluded any modification.

A brief examination of the literature revealed no empirical evidence supporting a contention that pharmacists tend to have a longer average working life than the general working male population. Available statistical data indicated the retirement patterns of this group to be somewhere between the general populace and other health professionals. Recent growth patterns of community pharmacist employees take into account the fact that many pharmacists are private wage and salary workers.[9] This suggests that a considerable number of these professionals may find it economically advantageous to retire at age 65. Nonetheless, to the extent that pharmacists may have a somewhat longer working life, the use of BLS retirement rates may overstate losses to the profession somewhat.[10]

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[6] Rusk, H. A; Diehl, H. S.; Barclay, R. W.; and Kaetzel, P. K. The Work Week of Physicians in Private Practice. *The New England Journal of Medicine* 249: 678-681, October 22, 1953.

[7] Beginning in 1968, the AMA changed its classification system for determining the professional activity of M.D.'s. The proportions of inactive M.D.'s used in the methodology (see Table A1) were derived by converting published AMA data on the old classification system to a distribution consistent with the new system. This procedure assumed that the 1967 age distribution of inactive M.D.'s applied to those M.D.'s converted to inactive status under the new AMA system; and that the reclassification of 1967 M.D.'s by activity would yield the same proportion of "new" inactives as reflected in 1968 data (new AMA system). See: Theodore, C. N.; Haug, J. N.; Balfe, B. E.; Roback, G. A.; and Franz, E. J. *Reclassification of Physicians, 1968.* Chicago, American Medical Association, 1971.

[8] A separate adjustment was undertaken for separation rates for female pharmacists. In this procedure, separation rates by age cohort were reduced by accession rates to make allowance for reentry into the active work force of females.

[9] Data from the 1970 Census of Population indicate that private wage and salary pharmacists account for over three-fourths of the total pharmacists employed. The 1960 Census indicates about 60 percent of all employed pharmacists were private wage and salary workers.

[10] As an *illustration*, if the male pharmacist retirement pattern approximated that of optometrists, the total active supply of pharmacists would be projected to number 186,300 by 1990, or 3.6 percent above of the projected supply shown in this report.

Table A1.

DERIVATION OF ADJUSTED SEPARATION RATE SERIES FOR ESTIMATING LOSSES TO THE WORKING PHYSICIAN (M.D.) POPULATION

Age group	General separation rates per 100,000 population			Adjustment factor for deaths			Adjustment factor for retirements			Adjusted separation rates per 100,000 population		
	Due to deaths	Due to retirements	Due to all causes	Deaths per 100,000 in in population with life expectancy of:		Adjustment factor (5) ÷ (4)	Proportion inactive, 1970		Adjustment factor (8) ÷ (7)	Due to deaths (1) x (6)	Due to retirements (2) x (9)	Due to all causes[1] (10) + (11)
				66.023 years	68.556 years		Males	M.D.'s				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
25-29	.0020	–	.0020	906	693	.7649	.0418	.0053	.1268	.0015	–	.0015
30-34	.0023	.0002	.0025	1,016	777	.7648	.0246	.0073	.2967	.0018	.0001	.0019
35-39	.0032	.0012	.0044	1,277	994	.7784	.0254	.0087	.3425	.0025	.0004	.0029
40-44	.0049	.0016	.0065	1,799	1,455	.8088	.0351	.0116	.3305	.0040	.0005	.0045
45-49	.0077	.0031	.0108	2,703	2,306	.8531	.0496	.0127	.2560	.0066	.0008	.0074
50-54	.0124	.0060	.0184	4,045	3,597	.8892	.0694	.0162	.2334	.0110	.0014	.0124
55-59	.0192	.0145	.0337	5,990	5,569	.9297	.1053	.0261	.2479	.0179	.0036	.0215
60-64	.0306	.0635	.0941	8,461	8,091	.9563	.2499	.0638	.2553	.0293	.0162	.0455
65-69	.0446	.1317	.1763	11,341	11,21	.9885	.5841	.1681	.2878	.0441	.0379	.0820
70-74	.0702	.1096	.1798	14,167	14,468	1.0213	.7478	.3344	.4472	.0717	.0490	.1207
75 and over.	.1020	.0863	.1883	40,931	45,378	1.1087	.8802	.6365	.7231	.1131	.0624	.1755

[1] In terms of aggregate average annual active physician loss rate, these rates correspond to 17.6 per 1,000 population in 1970, decreasing to 15.8 per 1,000 in 1990. The resulting annual loss to the total supply (active and inactive) is 15 per 1,000.

Source: Cols. 1-3: Fullerton, H. N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review* 94: 49-55, June 1971. Some rates were corrected in consultation with the author.

Cols. 4, 5: Coale, A. J. and Demeny, P. Regional Model Life Tables and Stable Populations. Princeton, New Jersey, Princeton University Press, 1966.

Col. 7: Unpublished data from Bureau of Labor Statistics.

Col. 8: Based on data in: Theodore, C. N. and Haug, J. N. Selected Characteristics of the Physician Population, 1963 and 1967. Chicago, American Medical Association, 1968.

Information was totally lacking on retirement patterns for allied health occupations covered in this report. However, the use of generalized age sex-specific retirement rates for this group of workers, seemed reasonable, given their general characteristics (e.g. education, wage-and-salary vs. self-employment, etc.), which appeared to be relatively similar to the general work force.

DEVELOPMENT OF ADJUSTED SEPARATION RATES

On the basis of techniques discussed above, consequently, "occupation-specific" death and retirement rate series were developed. A simple addition of these series, by age group, for each of the occupations resulted in an adjusted age-specific total separation series. (See Table A-1.)

As part of the overall analysis, an effort was made to validate the reasonableness of the adjusted separation series. Owing to constraints of data availability and time, however, this attempt at verification was confined solely to the series developed to estimate M.D. losses.

One test consisted of utilizing 1967 as a base year and projecting the number of active surviving physicians over a 20-year period, using a number of separation rates. A total of four different projections were developed, using (a) the adjusted separation series described earlier; (b) separation rates for the general working male population; (c) a technique used by Blumberg;[11] and (d) mortality rates developed by Dickinson.[12] In the last year of the 20-year period, these projections estimated active surviving M.D.'s to number (a) 170,600; (b) 139,800; (c) 178,000 and (d) 171,500 respectively. As can be seen, all except the second approach were clustered at about the same level.

Another test was also undertaken, one that applied the new separation series to 1959 AMA estimates of physicians in order to compare projected active survivors in 1970 with those actually reported by the AMA for that year. In effect, the application of the adjusted death and retirement series resulted in an estimate of 247,304 active U.S.-trained M.D.'s in 1970; a figure of 253,389 was actually indicated by AMA data.[13] Using a generalized separation series for all male workers, the figure was 251,318.

In sum, the two tests applied to the data suggested that estimates of M.D. losses derived by the adjusted series compared reasonably well with loss estimates indicated by other studies and suggested by AMA data,[14] and provided a relatively reasonable estimate on a retrospective basis.

LIMITATIONS OF THE APPROACH

In evaluating the results derived from the above methodology, the reader should keep in mind that the separation patterns utilized are not based on precise longitudinal data on actual death and retirement experiences of health professionals. Therefore, until reliable cohort analyses are undertaken for large segments of these groups over time, the separation patterns shown here are very difficult to validate in a rigorous fashion.[15]

In addition to the above considerations, several general limitations of the methodology (other than those noted in the text of the report) should be kept in mind. That is, the validity of the procedures used is dependent upon (a) conceptual adequacies of the abridgement technique applied; (b) definitional problems in the estimate of "active" health personnel; and (c) the conceptual weakness of relating labor force participation rates with proportions of health professionals that are active. For mortality estimates, furthermore, the assumption of a 2½-year longer average life expectancy for M.D.'s, although generally consistent with other study findings, nonetheless represents an assumption not entirely validated by detailed cohort analyses over time.

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[11] Blumberg, Mark S. *Trends and Projections of Physicians in the United States*, 1967-2002. Berkeley, Cal., Carnegie Commission on Higher Education, 1971.

[12] Dickinson, F. G. and Martin, L. W. *Physician Mortality, 1949-1951*. Bulletin 103. Chicago, American Medical Association, 1956. In both projections developed by BHRD, physician mortality rates from these studies were used on the total M.D. population, and then a reclassified 1967 "active" distribution derived from AMA data was utilized.

[13] The 253,389 figure represents a 1970 mid-year value to correspond to the 1959 AMA estimate. In addition to excluding 17,330 inactives and 2,070 addressees unknown from the AMA estimate of 270,637 total U.S. trained M.D.'s, an estimated 2,152 losses were added to adjust figure to mid-year estimate.

[14] When comparing the estimates obtained using the adjusted rates as opposed to the unadjusted series, it is important to note that virtually 75 percent of the difference results from using the retirement conversion factor.

[15] See text in Chapters 5 and 10 for a discussion of methods of estimating losses to dentist and registered nurse populations respectively.

Appendix B

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Table B1.

SUPPLY OF ACTIVE PHYSICIANS (M.D. AND D.O.), USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1971-90

Year	All active physicians	M.D.'s			D.O.'s
		Total	U.S. trained	Foreign[1] trained	
1970	323,205	311,203	251,237	59,966	12,002
1971	333,042	320,774	255,608	65,166	12,268
1972	343,375	330,831	260,465	70,366	12,544
1973	353,868	341,000	265,434	75,566	12,868
1974	365,211	351,979	271,213	80,766	13,232
1975	377,504	363,867	277,901	85,966	13,637
1976	390,788	376,659	285,493	91,166	14,129
1977	404,408	389,741	293,375	96,366	14,667
1978	418,441	403,153	301,587	101,566	15,288
1979	432,557	416,647	309,881	106,766	15,910
1980	446,767	430,237	318,271	111,966	16,530
1981	461,087	443,936	326,770	117,166	17,151
1982	475,454	457,684	335,318	122,366	17,770
1983	489,895	471,501	343,935	127,566	18,394
1984	504,435	485,417	352,651	132,766	19,018
1985	519,078	499,440	361,474	137,966	19,638
1986	533,833	513,574	370,408	143,166	20,259
1987	548,666	527,787	379,421	148,366	20,879
1988	563,587	542,089	388,523	153,566	21,498
1989	578,619	556,502	397,736	158,766	22,117
1990	593,759	571,026	407,060	163,966	22,733

[1] Includes Canadian trained physicians.

Source: 1970 M.D.'s: Haug, J. N. and Martin, B. C. *Foreign Medical Graduates in the United States, 1970.* Chicago, American Medical Association, 1971.

1970 D.O.'s: Unpublished data provided by the American Osteopathic Association.

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Table B2.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE PHYSICIANS (M.D. AND D.O.), USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31				Number active December 31
		Total net gain	U.S. graduate additions[1]	Net additions of foreign medical graduates[2]	Losses from deaths and retirements[3]	
1970	–	–	–	–	–	323,205
1971	323,205	9,837	9,451	5,200	4,814	333,042
1972	333,042	10,333	10,108	5,200	4,975	343,375
1973	343,375	10,493	10,396	5,200	5,103	353,868
1974	353,868	11,343	11,337	5,200	5,194	365,211
1975	365,211	12,293	12,353	5,200	5,260	377,504
1976	377,504	13,284	13,406	5,200	5,322	390,788
1977	390,788	13,620	13,902	5,200	5,482	404,408
1978	404,408	14,033	14,446	5,200	5,613	418,441
1979	418,441	14,116	14,633	5,200	5,717	432,557
1980	432,557	14,210	14,822	5,200	5,812	446,767
1981	446,767	14,320	15,014	5,200	5,894	461,087
1982	461,087	14,367	15,208	5,200	6,041	475,454
1983	475,454	14,441	15,404	5,200	6,163	489,895
1984	489,895	14,540	15,604	5,200	6,264	504,435
1985	504,435	14,643	15,805	5,200	6,362	519,078
1986	519,078	14,755	16,010	5,200	6,455	533,833
1987	533,833	14,833	16,217	5,200	6,584	548,666
1988	548,666	14,921	16,426	5,200	6,705	563,587
1989	563,587	15,032	16,639	5,200	6,807	578,619
1990	578,619	15,140	16,855	5,200	6,915	593,759

[1] Includes graduates of U.S. medical and osteopathic schools.

[2] Includes graduates of Canadian medical schools.

[3] Excludes losses among foreign medical graduate additions. These losses are already included in figures for net additions of foreign medical graduates.

Source: 1970 active physicians (M.D.): Haug, J. N.; Roback, G. A.; and Martin, B. C. *Distribution of Physicians in the United States 1970.* Chicago, American Medical Association, 1971.

1970 active physicians (D.O.): Unpublished data provided by the American Osteopathic Association.

Table B3.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE DENTISTS, USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Graduate additions	Losses from deaths and retirements	
1970	–	–	–	–	102,220
1971	102,220	1,530	3,760	2,230	103,750
1972	103,750	1,650	3,920	2,280	105,400
1973	105,400	1,920	4,220	2,300	107,320
1974	107,320	2,250	4,570	2,320	109,570
1975	109,570	2,420	4,740	2,320	111,990
1976	111,990	2,720	5,060	2,340	114,710
1977	114,710	2,770	5,140	2,370	117,480
1978	117,480	2,830	5,210	2,380	120,310
1979	120,310	2,890	5,290	2,400	123,200
1980	123,200	2,970	5,370	2,400	126,170
1981	126,170	3,010	5,440	2,430	129,180
1982	129,180	2,980	5,440	2,460	132,160
1983	132,160	2,960	5,440	2,480	135,120
1984	135,120	2,920	5,440	2,520	138,040
1985	138,040	2,910	5,440	2,530	140,950
1986	140,950	2,870	5,440	2,570	143,820
1987	143,820	2,840	5,440	2,600	146,660
1988	146,660	2,790	5,440	2,650	149,450
1989	149,450	2,760	5,440	2,680	152,210
1990	152,210	2,700	5,440	2,740	154,910

Source: BHRD, Division of Dental Health.

Table B4.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE OPTOMETRISTS, USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Graduate additions	Losses from deaths and retirements	
1970	–	–	–	–	18,445
1971	18,445	85	528	443	18,530
1972	18,530	237	683	446	18,767
1973	18,767	241	691	450	19,008
1974	19,008	322	775	453	19,330
1975	19,330	348	817	469	19,678
1976	19,678	409	891	482	20,087
1977	20,087	411	904	493	20,498
1978	20,498	420	924	504	20,918
1979	20,918	443	956	513	21,361
1980	21,361	458	988	530	21,819
1981	21,819	483	1,022	539	22,302
1982	22,302	507	1,057	550	22,809
1983	22,809	533	1,093	560	23,342
1984	23,342	562	1,130	568	23,904
1985	23,904	592	1,168	576	24,496
1986	24,496	621	1,208	587	25,117
1987	25,117	657	1,249	592	25,774
1988	25,774	697	1,292	595	26,471
1989	26,471	732	1,336	604	27,203
1990	27,203	775	1,381	606	27,978

Source; 1970 active optometrists: Based on 1968 Survey of Optometrists by National Center for Health Statistics.

Table B5.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE PHARMACISTS, USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1971-90

Year	Number active January 1	Net gains	Changes in supply January 1 – December 31			Number active December 31
			Graduate additions		Losses deaths and retirements	
			Male	Female		
1970	–	–	–	–	–	129,287
1971	129,287	306	3,773	973	4,400	129,593
1972	129,593	263	3,567	1,006	4,310	129,856
1973	129,856	758	3,842	1,143	4,227	130,614
1974	130,614	1,442	4,261	1,331	4,150	132,056
1975	132,056	1,771	4,393	1,433	4,055	133,827
1976	133,827	2,055	4,481	1,521	3,947	135,882
1977	135,882	2,310	4,552	1,604	3,846	138,192
1978	138,192	2,471	4,579	1,670	3,778	140,663
1979	140,663	2,633	4,609	1,735	3,711	143,296
1980	143,296	2,793	4,641	1,799	3,647	146,089
1981	146,089	2,936	4,674	1,864	3,602	149,025
1982	149,025	3,044	4,709	1,928	3,593	152,069
1983	152,069	3,154	4,747	1,991	3,584	155,223
1984	155,223	3,263	4,786	2,054	3,577	158,486
1985	158,486	3,368	4,826	2,117	3,575	161,854
1986	161,854	3,463	4,868	2,180	3,585	165,317
1987	165,317	3,523	4,912	2,243	3,632	168,840
1988	168,840	3,596	4,958	2,305	3,667	172,436
1989	172,436	3,667	5,004	2,368	3,705	176,103
1990	176,103	3,750	5,053	2,431	3,734	179,853

Source: 1970 active pharmacists: National Association of Boards of Pharmacy. 1971 Proceedings. *Licensure Statistics and Census of Pharmacy*. Chicago, The Association, 1972.

Table B6.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE PODIATRISTS, USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Graduate additions	Losses from deaths and retirements	
1970	–	–	–	–	7,148
1971	7,148	15	242	227	7,163
1972	7,163	59	286	227	7,222
1973	7,222	34	266	232	7,256
1974	7,256	79	309	230	7,335
1975	7,335	135	368	233	7,470
1976	7,470	147	380	233	7,617
1977	7,617	186	420	234	7,803
1978	7,803	218	455	237	8,021
1979	8,021	245	478	233	8,266
1980	8,266	267	502	235	8,533
1981	8,533	294	527	223	8,827
1982	8,827	324	554	230	9,151
1983	9,151	352	581	229	9,503
1984	9,503	384	610	226	9,887
1985	9,887	418	641	223	10,305
1986	10,305	452	673	221	10,757
1987	10,757	490	706	216	11,247
1988	11,247	531	742	211	11,778
1989	11,778	567	778	211	12,345
1990	12,345	606	817	211	12,951

Source: 1970 active podiatrists: Koch, Hugo K. and Phillips, Hazel M. *Podiatry Manpower: A General Profile. United States - 1970.* DHEW Pub. No. (HRA) 74-1805. U.S. Government Printing Office, 1973.

Table B7.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE VETERINARIANS, USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Graduate additions	Losses from deaths and retirements	
1970	–	–	–	–	25,935
1971	25,935	909	1,239	330	26,844
1972	26,844	910	1,252	342	27,754
1973	27,754	912	1,266	354	28,666
1974	28,666	1,018	1,381	363	29,684
1975	29,684	1,038	1,412	374	30,722
1976	30,722	1,076	1,465	389	31,798
1977	31,798	1,129	1,541	412	32,927
1978	32,927	1,136	1,576	440	34,063
1979	34,063	1,140	1,605	465	35,203
1980	35,203	1,148	1,634	486	36,351
1981	36,351	1,155	1,664	509	37,506
1982	37,506	1,152	1,694	542	38,658
1983	38,658	1,155	1,724	569	39,813
1984	39,813	1,160	1,755	595	40,973
1985	40,973	1,165	1,787	622	42,138
1986	42,138	1,172	1,819	647	43,310
1987	43,310	1,179	1,852	673	44,489
1988	44,489	1,190	1,885	695	45,679
1989	45,679	1,204	1,919	715	46,883
1990	46,883	1,217	1,953	736	48,100

Source: 1970 active veterinarians: Based on data from the American Veterinary Medical Association.

Table B8.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF ACTIVE REGISTERED NURSES, USING BASIC METHODOLOGY: ACTUAL 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Graduate additions	Net attrition	
1970	–	–	–	–	723,000
1971	723,000	24,810	46,500	21,690	747,810
1972	747,810	28,870	51,304	22,434	776,680
1973	776,680	33,629	56,929	23,300	810,309
1974	810,309	37,642	61,951	24,309	847,951
1975	847,951	41,425	66,864	25,439	889,376
1976	889,376	43,396	70,077	26,681	932,772
1977	932,772	42,688	70,671	27,983	975,460
1978	975,460	42,029	71,293	29,264	1,017,489
1979	1,017,489	41,385	71,909	30,524	1,058,874
1980	1,058,874	40,752	72,518	31,766	1,099,626
1981	1,099,626	40,147	73,136	32,989	1,139,773
1982	1,139,773	39,552	73,745	34,193	1,179,325
1983	1,179,325	38,996	74,375	35,379	1,218,321
1984	1,218,321	38,510	75,060	36,550	1,256,831
1985	1,256,831	37,699	75,404	37,705	1,294,530
1986	1,294,530	36,784	75,620	38,836	1,331,314
1987	1,331,314	35,578	75,517	39,939	1,366,892
1988	1,366,892	34,408	75,415	41,007	1,401,300
1989	1,401,300	33,273	75,312	42,039	1,434,573
1990	1,434,573	32,172	75,209	43,037	1,466,745

Source: 1970 active registered nurses: American Nurses' Association. *Facts About Nursing. A Statistical Summary*. 1970-71 edition. New York, The Association, 1971.

Table B9.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED DIETITIANS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains or losses	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	15,300
1971	15,300	-23	865	888	15,277
1972	15,277	122	905	783	15,399
1973	15,399	188	960	772	15,587
1974	15,587	241	992	751	15,828
1975	15,828	311	1,049	738	16,139
1976	16,139	363	1,103	740	16,502
1977	16,502	370	1,155	785	16,872
1978	16,872	400	1,210	810	17,272
1979	17,272	443	1,266	823	17,715
1980	17,715	459	1,303	844	18,174
1981	18,174	471	1,337	866	18,645
1982	18,645	454	1,371	917	19,099
1983	19,099	457	1,398	941	19,556
1984	19,556	463	1,429	966	20,019
1985	20,019	453	1,437	984	20,472
1986	20,472	447	1,447	1,000	20,919
1987	20,919	394	1,433	1,039	21,313
1988	21,313	367	1,418	1,051	21,680
1089	21,680	340	1,400	1,060	22,020
1990	22,020	324	1,384	1,060	22,344

Source: 1970 active dietitians: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B10.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED MEDICAL RECORD ADMINISTRATORS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	4,200
1971	4,200	3	254	251	4,203
1972	4,203	47	271	224	4,250
1973	4,250	66	288	222	4,316
1974	4,316	79	297	218	4,395
1975	4,395	104	315	211	4,499
1976	4,499	115	330	215	4,614
1977	4,614	120	346	226	4,734
1978	4,734	129	363	234	4,863
1979	4,863	135	379	244	4,998
1980	4,998	139	390	251	5,137
1981	5,137	141	401	260	5,278
1982	5,278	143	411	268	5,421
1983	5,421	141	419	278	5,562
1984	5,562	146	428	282	5,708
1985	5,708	143	431	288	5,851
1986	5,851	138	434	296	5,989
1987	5,989	126	429	303	6,115
1988	6,115	114	425	311	6,229
1989	6,229	108	420	312	6,337
1990	6,337	97	415	318	6,434

Source: 1970 active medical record administrators: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B11.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED MEDICAL TECHNOLOGISTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	45,000
1971	45,000	2,612	5,367	2,755	47,612
1972	47,612	2,771	5,617	2,846	50,383
1973	50,383	3,031	5,959	2,928	53,414
1974	53,414	3,224	6,158	2,934	56,638
1975	56,638	3,527	6,512	2,985	60,165
1976	60,165	3,769	6,842	3,073	63,934
1977	63,934	3,905	7,165	3,260	67,839
1978	67,839	4,079	7,508	3,429	71,918
1979	71,918	4,298	7,856	3,558	76,216
1980	76,216	4,399	8,086	3,687	80,615
1981	80,615	4,484	8,297	3,813	85,099
1982	85,099	4,430	8,509	4,079	89,529
1983	89,529	4,465	8,677	4,212	93,994
1984	93,994	4,535	8,870	4,335	98,529
1985	98,529	4,478	8,919	4,441	103,007
1986	103,007	4,450	8,982	4,532	107,457
1987	107,457	4,269	8,895	4,626	111,726
1988	111,726	4,102	8,801	4,699	115,828
1989	115,828	3,921	8,689	4,768	119,749
1990	119,749	3,769	8,590	4,821	123,518

Source: 1970 active medical technologists: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B12.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED OCCUPATIONAL THERAPISTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	7,300
1971	7,300	310	769	459	7,610
1972	7,610	389	804	415	7,999
1973	7,999	407	852	445	8,406
1974	8,406	417	881	464	8,823
1975	8,823	449	932	483	9,272
1976	9,272	473	979	506	9,745
1977	9,745	470	1,025	555	10,215
1978	10,215	494	1,074	580	10,709
1979	10,709	521	1,124	603	11,230
1980	11,230	531	1,157	626	11,761
1981	11,761	541	1,187	646	12,302
1982	12,302	545	1,218	673	12,847
1983	12,847	550	1,242	692	13,397
1984	13,397	556	1,269	713	13,953
1985	13,953	545	1,276	731	14,498
1986	14,498	541	1,285	744	15,039
1987	15,039	494	1,273	779	15,533
1988	15,533	471	1,259	788	16,004
1989	16,004	447	1,243	796	16,451
1990	16,451	429	1,229	800	16,880

Source: 1970 active occupational therapists: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B13.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED PHYSICAL THERAPISTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	11,550
1971	11,550	899	1,547	648	12,449
1972	12,449	971	1,616	645	13,420
1973	13,420	1,024	1,715	691	14,444
1974	14,444	1,060	1,772	712	15,504
1975	15,504	1,135	1,874	739	16,639
1976	16,639	1,195	1,969	774	17,834
1977	17,834	1,220	2,062	842	19,054
1978	19,054	1,274	2,161	887	20,328
1979	20,328	1,337	2,261	924	21,665
1980	21,665	1,365	2,327	962	23,030
1981	23,030	1,390	2,388	998	24,420
1982	24,420	1,397	2,449	1,052	25,817
1983	25,817	1,410	2,497	1,087	27,227
1984	27,227	1,436	2,553	1,117	28,663
1985	28,663	1,420	2,567	1,147	30,083
1986	30,083	1,411	2,585	1,174	31,494
1987	31,494	1,339	2,560	1,221	32,833
1988	32,833	1,292	2,533	1,241	34,125
1989	34,125	1,245	2,501	1,256	35,370
1990	35,370	1,202	2,472	1,270	36,572

Source: 1970 active physical therapists: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B 14.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED SPEECH PATHOLOGISTS AND AUDIOLOGISTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	13,300
1971	13,300	1,745	2,585	840	15,045
1972	15,045	1,902	2,747	845	16,947
1973	16,947	2,058	2,955	897	19,005
1974	19,005	2,198	3,162	964	21,203
1975	21,203	2,356	3,393	1,037	23,559
1976	23,559	2,457	3,578	1,121	26,016
1977	26,016	2,575	3,797	1,222	28,591
1978	28,591	2,709	4,005	1,296	31,300
1979	31,300	2,821	4,189	1,368	34,121
1980	34,121	2,944	4,386	1,442	37,065
1981	37,065	3,055	4,570	1,515	40,120
1982	40,120	3,228	4,847	1,619	43,348
1983	43,348	3,351	5,055	1,704	46,699
1984	46,699	3,465	5,251	1,786	50,164
1985	50,164	3,561	5,424	1,863	53,725
1986	53,725	3,583	5,517	1,934	57,308
1987	57,308	3,517	5,551	2,034	60,825
1988	60,825	3,444	5,540	2,096	64,269
1989	64,269	3,375	5,528	2,153	67,644
1990	67,644	3,281	5,482	2,201	70,925

Source: 1970 active speech pathologists and audiologists: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B15.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED CERTIFIED LABORATORY ASSISTANTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	6,700
1971	6,700	1,259	1,969	710	7,959
1972	7,959	1,313	2,131	818	9,272
1973	9,272	1,373	2,305	932	10,645
1974	10,645	1,438	2,479	1,041	12,083
1975	12,083	1,511	2,640	1,129	13,594
1976	13,594	1,601	2,801	1,200	15,195
1977	15,195	1,675	2,962	1,287	16,870
1978	16,870	1,725	3,109	1,384	18,595
1979	18,595	1,781	3,257	1,476	20,376
1980	20,376	1,885	3,444	1,559	22,261
1981	22,261	1,928	3,565	1,637	24,189
1982	24,189	1,934	3,659	1,725	26,123
1983	26,123	1,951	3,752	1,801	28,074
1984	28,074	1,937	3,806	1,869	30,011
1985	30,011	1,937	3,860	1,923	31,948
1986	31,948	1,910	3,886	1,976	33,858
1987	33,858	1,888	3,913	2,025	35,746
1988	35,746	1,855	3,913	2,058	37,601
1989	37,601	1,808	3,900	2,092	39,409
1990	39,409	1,753	3,873	2,120	41,162

Source: 1970 active certified laboratory assistants: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B16.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED CYTOTECHNOLOGISTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	2,400
1971	2,400	189	340	151	2,589
1972	2,589	186	368	182	2,775
1973	2,775	196	398	202	2,971
1974	2,971	208	428	220	3,179
1975	3,179	219	455	236	3,398
1976	3,398	231	483	252	3,629
1977	3,629	243	511	268	3,872
1978	3,872	251	536	285	4,123
1979	4,123	263	562	299	4,386
1980	4,386	281	594	313	4,667
1981	4,667	286	615	329	4,953
1982	4,953	286	631	345	5,239
1983	5,239	288	647	359	5,527
1984	5,527	282	656	374	5,809
1985	5,809	280	666	386	6,089
1986	6,089	270	670	400	6,359
1987	6,359	272	675	403	6,631
1988	6,631	269	675	406	6,900
1989	6,900	256	673	417	7,156
1990	7,156	244	668	424	7,400

Source: 1970 active cytotechnologists: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B17.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED DENTAL ASSISTANTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	9,200
1971	9,200	2,925	3,954	1,029	12,125
1972	12,125	2,866	4,277	1,411	14,991
1973	14,991	2,818	4,627	1,809	17,809
1974	17,809	2,817	4,977	2,160	20,626
1975	20,626	2,866	5,299	2,433	23,492
1976	23,492	2,966	5,622	2,656	26,458
1977	26,458	3,050	5,945	2,895	29,508
1978	29,508	3,104	6,241	3,137	32,612
1979	32,612	3,171	6,537	3,366	35,783
1980	35,783	3,328	6,913	3,585	39,111
1981	39,111	3,375	7,155	3,780	42,486
1982	42,486	3,357	7,344	3,987	45,843
1983	45,843	3,377	7,532	4,155	49,220
1984	49,220	3,336	7,640	4,304	52,556
1985	52,556	3,319	7,747	4,428	55,875
1986	55,875	3,262	7,801	4,539	59,137
1987	59,137	3,226	7,855	4,629	62,363
1988	62,363	3,150	7,855	4,705	65,513
1989	65,513	3,061	7,828	4,767	68,574
1990	68,574	2,952	7,774	4,822	71,526

Source: 1970 active dental assistants: BHRD, Division of Dental Health.

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Table B 18.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED DENTAL HYGIENISTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	15,100
1971	15,100	1,402	2,872	1,470	16,502
1972	16,502	1,548	3,107	1,559	18,050
1973	18,050	1,646	3,361	1,715	19,696
1974	19,696	1,749	3,615	1,866	21,445
1975	21,445	1,866	3,849	1,983	23,311
1976	23,311	2,009	4,084	2,075	25,320
1977	25,320	2,096	4,318	2,222	27,416
1978	27,416	2,163	4,533	2,370	29,579
1979	29,579	2,235	4,748	2,513	31,814
1980	31,814	2,372	5,022	2,650	34,186
1981	34,186	2,432	5,198	2,766	36,618
1982	36,618	2,425	5,334	2,909	39,043
1983	39,043	2,449	5,471	3,022	41,492
1984	41,492	2,421	5,549	3,128	43,913
1985	43,913	2,411	5,628	3,217	46,324
1986	46,324	2,375	5,667	3,292	48,699
1987	48,699	2,337	5,706	3,369	51,036
1988	51,036	2,283	5,706	3,423	53,319
1989	53,319	2,210	5,686	3,476	55,529
1990	55,529	2,125	5,647	3,522	57,654

Source: 1970 active dental hygienists: BHRD, Division of Dental Health.

Table B19.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED DENTAL LABORATORY TECHNICIANS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	1,600
1971	1,600	413	447	34	2,013
1972	2,013	444	483	39	2,457
1973	2,457	473	523	50	2,930
1974	2,930	503	562	59	3,433
1975	3,433	536	599	63	3,969
1976	3,969	562	635	73	4,531
1977	4,531	594	672	78	5,125
1978	5,125	620	705	85	5,745
1979	5,745	643	739	96	6,388
1980	6,388	680	781	101	7,068
1981	7,068	698	809	111	7,766
1982	7,766	707	830	123	8,473
1983	8,473	725	851	126	9,198
1984	9,198	730	863	133	9,928
1985	9,928	738	876	138	10,666
1986	10,666	737	882	145	11,403
1987	11,403	735	888	153	12,138
1988	12,138	730	888	158	12,868
1989	12,868	719	885	166	13,587
1990	13,587	707	879	172	14,294

Source: 1970 active dental laboratory technicians: BHRD, Division of Dental Health.

Table B20.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED LICENSED PRACTICAL NURSES: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	400,000
1971	400,000	11,017	40,383	29,366	411,017
1972	411,017	11,848	43,801	31,153	422,865
1973	422,865	12,672	47,345	34,673	435,537
1974	435,537	13,750	50,827	37,077	449,287
1975	449,287	15,390	54,245	38,855	464,677
1976	464,677	17,401	57,536	40,135	482,078
1977	482,078	18,776	60,701	41,925	500,854
1978	500,854	20,037	63,802	43,765	520,891
1979	520,891	21,446	66,967	45,521	542,337
1980	542,337	23,550	70,726	47,176	565,887
1981	565,887	24,623	73,203	48,580	590,510
1982	590,510	25,169	75,130	49,961	615,679
1983	615,679	25,819	77,057	51,238	641,498
1984	641,498	25,855	78,157	52,302	667,353
1985	667,353	26,065	79,258	53,193	693,418
1986	693,418	25,912	79,808	53,896	719,330
1987	719,330	25,893	80,358	54,465	745,223
1988	745,223	25,484	80,358	54,874	770,707
1989	770,707	24,921	80,083	55,162	795,628
1990	795,628	24,158	79,533	55,375	819,786

Source: 1970 active licensed practical nurses: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B21.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED RESPIRATORY THERAPISTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	3,850
1971	3,850	530	749	219	4,380
1972	4,380	568	811	243	4,948
1973	4,948	590	878	288	5,538
1974	5,538	616	944	328	6,154
1975	6,154	646	1,005	359	6,800
1976	6,800	685	1,066	381	7,485
1977	7,485	714	1,128	414	8,199
1978	8,199	738	1,184	446	8,937
1979	8,937	766	1,240	474	9,703
1980	9,703	808	1,311	503	10,511
1981	10,511	828	1,357	529	11,339
1982	11,339	834	1,393	559	12,173
1983	12,173	847	1,428	581	13,020
1984	13,020	847	1,449	602	13,867
1985	13,867	849	1,469	620	14,716
1986	14,716	840	1,479	639	15,556
1987	15,556	837	1,490	653	16,393
1988	16,393	824	1,490	666	17,217
1989	17,217	807	1,485	678	18,024
1990	18,024	784	1,474	690	18,808

Source: 1970 active respiratory therapists: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B22.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED MEDICAL RECORD TECHNICIANS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	3,800
1971	3,800	23	269	246	3,823
1972	3,823	58	291	233	3,881
1973	3,881	71	315	244	3,952
1974	3,952	92	339	247	4,044
1975	4,044	112	361	249	4,156
1976	4,156	130	383	253	4,286
1977	4,286	142	405	263	4,428
1978	4,428	147	425	278	4,575
1979	4,575	154	445	291	4,729
1980	4,729	171	471	300	4,900
1981	4,900	170	487	317	5,070
1982	5,070	162	500	338	5,232
1983	5,232	162	513	351	5,394
1984	5,394	162	520	358	5,556
1985	5,556	161	527	366	5,717
1986	5,717	155	531	376	5,872
1987	5,872	153	535	382	6,025
1988	6,025	151	535	384	6,176
1989	6,176	144	533	389	6,320
1990	6,320	139	529	390	6,459

Source: 1970 active medical record technicians: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B23.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED OCCUPATIONAL THERAPY ASSISTANTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	600
1971	600	328	381	53	928
1972	928	332	412	80	1,260
1973	1,260	343	446	103	1,603
1974	1,603	353	480	127	1,956
1975	1,956	365	511	146	2,321
1976	2,321	376	542	166	2,697
1977	2,697	394	573	179	3,091
1978	3,091	405	601	196	3,496
1979	3,496	420	630	210	3,916
1980	3,916	439	666	227	4,355
1981	4,355	445	689	244	4,800
1982	4,800	450	707	257	5,250
1983	5,250	457	726	269	5,707
1984	5,707	456	736	280	6,163
1985	6,163	458	746	288	6,621
1986	6,621	451	752	301	7,072
1987	7,072	452	757	305	7,524
1988	7,524	443	757	314	7,967
1989	7,967	431	754	323	8,398
1990	8,398	419	749	330	8,817

Source: 1970 active occupational therapy assistants: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Table B24.

ANNUAL ADDITIONS AND LOSSES TO THE SUPPLY OF FORMALLY-TRAINED RADIOLOGIC TECHNOLOGISTS: 1970 AND PROJECTED 1971-90

Year	Number active January 1	Changes in supply January 1 – December 31			Number active December 31
		Net gains	Additions from graduates of approved programs	Losses from deaths and retirements	
1970	–	–	–	–	41,000
1971	41,000	3,769	6,661	2,892	44,769
1972	44,769	4,303	7,205	2,902	49,072
1973	49,072	4,546	7,794	3,238	53,618
1974	53,618	4,824	8,383	3,559	58,442
1975	58,442	5,126	8,926	3,800	63,568
1976	63,568	5,477	9,470	3,993	69,045
1977	69,045	5,742	10,014	4,272	74,787
1978	74,787	5,972	10,512	4,540	80,759
1979	80,759	6,208	11,011	4,803	86,967
1980	86,967	6,588	11,645	5,057	93,555
1981	93,555	6,774	12,053	5,279	100,329
1982	100,329	6,763	12,370	5,607	107,092
1983	107,092	6,876	12,687	5,811	113,968
1984	113,968	6,887	12,868	5,981	120,855
1985	120,855	6,915	13,050	6,135	127,770
1986	127,770	6,875	13,140	6,265	134,645
1987	134,645	6,843	13,231	6,388	141,488
1988	141,488	6,736	13,231	6,495	148,224
1989	148,224	6,610	13,186	6,576	154,834
1990	154,834	6,446	13,095	6,649	161,280

Source: 1970 active radiologic technologists: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.

Appendix C.

UPDATED TABLES

As indicated in Chapter 1, December 31, 1970 was adopted as the base year for the development of individual practitioner profiles and as a base year for the projections. However, in many occupations, more recent manpower statistics are available, some of which have been presented earlier in individual chapters. This appendix provides additional current statistics.

The following material does not purport to represent an exhaustive current profile of health professions and allied health occupations. It is intended simply to assist readers by providing supplemental, more current information than that presented earlier. Data presented for M.D.'s have been taken directly from AMA publications and, as such, are not totally comparable with figures presented in Chapters 3 and 4.

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Table C1.

NUMBER OF NON-FEDERAL PHYSICIANS (M.D.) PROVIDING PATIENT CARE AND PHYSICIAN/POPULATION RATIOS IN THE UNITED STATES, BY STATE: DECEMBER 31, 1972

State	Number of non-Federal physicians providing patient care	Rate per 100,000 population	Civilian population 7/1/72 (1,000's)
United States	266,587	129	206,451
Alabama	2,841	81	3,486
Alaska	224	75	298
Arizona	2,466	129	1,915
Arkansas	1,620	82	1,969
California	33,606	167	20,131
Colorado	3,343	144	2,314
Connecticut	5,087	166	3,065
Delaware	694	124	559
District of Columbia	2,508	340	738
Florida	9,181	128	7,163
Georgia	4,633	99	4,665
Hawaii	1,079	142	759
Idaho	652	87	751
Illinois	13,539	121	11,212
Indiana	4,921	93	5,283
Iowa	2,609	91	2,882
Kansas	2,259	101	2,227
Kentucky	3,078	94	3,268
Louisiana	3,883	105	3,685
Maine	999	98	1,017
Maryland	6,224	156	3,995
Massachusetts	10,252	178	5,766
Michigan	10,163	112	9,067
Minnesota	5,000	128	3,893
Mississippi	1,685	75	2,241
Missouri	5,388	114	4,724
Montana	694	97	713
Nebraska	1,532	101	1,513
Nevada	537	103	519
New Hampshire	920	120	767
New Jersey	9,389	128	7,320
New Mexico	1,036	99	1,050
New York	36,161	197	18,338
North Carolina	5,000	98	5,121
North Dakota	524	85	620
Ohio	12,682	118	10,768
Oklahoma	2,339	90	2,607
Oregon	2,800	128	2,179
Pennsylvania	15,735	132	11,915
Rhode Island	1,380	147	937
South Carolina	2,218	85	2,597
South Dakota	482	72	673
Tennessee	4,193	104	4,013
Texas	12,258	107	11,496
Utah	1,429	127	1,121
Vermont	694	150	462

See footnotes at end of table.

Table C1.

NUMBER OF NON-FEDERAL PHYSICIANS (M.D.) PROVIDING PATIENT CARE AND PHYSICIAN/POPULATION RATIOS IN THE UNITED STATES, BY STATE: DECEMBER 31, 1972—Continued

State	Number of non-Federal physicians providing patient care	Rate per 100,000 population	Civilian population 7/1/72 (1,000's)
Virginia	5,217	113	4,604
Washington	4,446	131	3,406
West Virginia	1,692	95	1,780
Wisconsin	4,984	110	4,518
Wyoming	311	91	341

Source: American Medical Association. *Profile of Medical Practice.* 1973 edition.
U.S. Bureau of the Census. *Current Population Reports.* Series P-25, No. 488.

Table C2.

NUMBER OF ACTIVE FEDERAL AND NON-FEDERAL PHYSICIANS (M.D.), BY MAJOR PROFESSIONAL ACTIVITY: DECEMBER 31, 1972

Major professional activity	Total active physicians		Federal		Non-Federal	
	Number	Percent	Number	Percent	Number	Percent
All activities	[1] 320,903	100.0	27,580	100.0	[1] 293,323	100.0
Patient care	292,210	91.1	23,115	83.8	269,095	91.7
Office based	201,302	62.7	2,328	8.4	198,974	69.8
Hospital based	90,908	28.3	20,787	75.4	70,121	23.9
Other professional activity	28,693	8.9	4,465	16.2	24,228	8.3
Medical teaching	5,636	1.8	499	1.8	5,137	1.8
Administration	11,074	3.5	2,197	8.0	8,877	3.0
Research	9,290	2.9	1,361	4.9	7,929	2.7
Other	2,693	0.8	408	1.5	2,285	0.8

[1] Excludes 12,356 physicians "not classified". If the percent active among all physicians is applied to the "not classified" physicians, the estimated number of active physicians would be 332,530.

Source: American Medical Association. *Profile of Medical Practice.* 1973 edition.

Note: Figures may not add to totals and subtotals due to independent rounding.

Table C3.

NEW LICENTIATES REPRESENTING ADDITIONS TO THE MEDICAL PROFESSION, BY PLACE IN WHICH LICENSED AND PLACE OF TRAINING: 1972

Place in which licensed	Total new licentiates	New licentiates graduating from foreign schools	FMG's as percent of total new licentiates
United States	14,476	[1] 6,808	47.0
Alabama	51	1	2.0
Alaska	26	10	38.5
Arizona	85	33	38.8
Arkansas	103	7	6.8
California	1,370	172	12.6
Colorado	100	4	4.0
Connecticut	81	45	55.6
Delaware	55	49	89.1
District of Columbia	202	106	52.5
Florida	406	257	63.3
Georgia	372	109	29.3
Hawaii	40	16	40.0
Idaho	4	0	–
Illinois	826	638	77.2
Indiana	223	15	6.7
Iowa	132	23	17.4
Kansas	162	48	29.6
Kentucky	192	34	17.7
Louisiana	244	25	10.2
Maine	85	70	82.4
Maryland	354	116	32.8
Massachusetts	343	152	44.3
Michigan	901	659	73.1
Minnesota	[2] 20	[2] 0	–
Mississippi	114	6	5.3
Missouri	557	337	60.5
Montana	5	0	–
Nebraska	111	4	3.6
Nevada	2	1	50.0
New Hampshire	28	16	57.1
New Jersey	174	116	66.7
New Mexico	77	25	32.5
New York	2,136	1,129	52.9
North Carolina	215	28	13.0
North Dakota	67	62	92.5
Ohio	728	418	57.4
Oklahoma	108	12	11.1
Oregon	51	4	7.8
Pennsylvania	1,351	910	67.4
Rhode Island	36	19	52.8
South Carolina	67	0	–
South Dakota	28	13	46.4
Tennessee	244	44	18.0
Texas	390	72	18.5
Utah	68	10	14.7
Vermont	213	180	84.5
Virginia	727	531	73.0
Washington	189	55	29.1
West Virginia	99	60	60.6

See footnotes at end of table.

Table C3.

NEW LICENTIATES REPRESENTING ADDITIONS TO THE MEDICAL PROFESSION, BY PLACE IN WHICH LICENSED AND PLACE OF TRAINING: 1972—Continued

Place in which licensed	Total new licentiates	New licentiates graduating from foreign schools	FMG's as percent of total new licentiates
Wisconsin	149	50	33.6
Wyoming	7	2	28.6
Guam	6	6	100.0
Puerto Rico	149	109	73.2
Virgin Islands	3	0	—

[1] Includes 147 graduates of Canadian medical schools.
[2] Incomplete report.

Source: American Medical Association, Council on Medical Education. *Medical Licensure Statistics for 1972.* Chicago, The Association 1973.

Table C4.

NUMBER AND PERCENT DISTRIBUTION OF ACTIVE PHYSICIANS (M.D.) BY SPECIALTY: DECEMBER 31, 1972

Specialty	Number of physicians	Percent
Total active physicians	[1] 320,903	100.0
General practice[2]	55,348	17.2
Medical specialties	72,728	22.7
Dermatology	4,227	1.3
Internal medicine	47,994	15.0
Pediatrics[3]	20,507	6.4
Surgical specialties	90,409	28.2
General surgery	30,989	9.7
Neurological surgery	2,753	0.9
Obstetrics and gynecology	20,202	6.3
Ophthalmology	10,443	3.3
Orthopedic surgery	10,356	3.2
Otolaryngology	5,662	1.8
Plastic surgery	1,786	0.6
Thoracic surgery	1,927	0.6
Urology	6,291	2.0
Other specialties	102,418	31.9
Anesthesiology	11,853	3.7
Child psychiatry	2,268	0.7
Neurology	3,494	1.1
Psychiatry	22,570	7.0
Pathology[4]	11,218	3.5
Physical medicine and rehabilitation	1,551	0.5
Radiology[5]	14,917	4.6
Miscellaneous[6]	34,547	10.8

[1] Excludes 12,256 "not classified".
[2] Includes family practice.
[3] Includes pediatric allergy and pediatric cardiology.
[4] Includes forensic pathology.
[5] Includes therapeutic radiology and diagnostic radiology.
[6] Includes also physicians with unspecified specialty.

Source: American Medical Association. *Profile of Medical Practice*. 1973 edition.

Note: Figures may not add to totals and subtotals due to independent rounding.

Table C5.

NUMBER AND PERCENT OF ACTIVE PHYSICIANS (M.D.) ENGAGED IN PRIMARY CARE: DECEMBER 31, 1972

Specialty	Number of physicians	Percent
Total active physicians	320,903[1]	100.0
Primary care, total	144,051	44.9
General practice[2]	55,348	17.2
Internal medicine	47,994	15.0
Pediatrics[3]	20,507	6.4
Obstetrics, gynecology	20,202	6.3
All other	176,852	55.1

[1] Excludes 12,256 physicians "not classified".
[2] Includes family practice.
[3] Includes pediatric allergy and pediatric cardiology.

Source: American Medical Association. *Profile of Medical Practice.* 1973 edition.

Table C6.

NUMBER OF CIVILIAN DENTISTS AND DENTIST/POPULATION RATIOS, BY STATE: DECEMBER 31, 1972

State	Civilian population July 1, 1972 (in 1,000's)	Number of civilian dentists		Rate per 100,000 population	
		Total	Active	Total	Active
UNITED STATES	206,451	112,270	97,970	54	47
Alabama	3,486	1,159	1,045	33	30
Alaska	298	105	101	35	34
Arizona	1,915	810	731	42	38
Arkansas	1,969	682	604	35	31
California	20,131	13,252	11,664	66	58
Colorado	2,314	1,306	1,174	56	51
Connecticut	3,065	2,099	1,847	68	60
Delaware	559	239	220	43	39
District of Columbia	738	784	675	106	91
Florida	7,163	3,047	2,618	43	37
Georgia	4,665	1,583	1,421	34	30
Hawaii	759	522	460	69	61
Idaho	751	369	327	49	44
Illinois	11,212	6,568	5,573	59	50
Indiana	5,283	2,399	2,104	45	40
Iowa	2,882	1,561	1,320	54	46
Kansas	2,227	1,093	947	49	43
Kentucky	3,268	1,310	1,176	40	36
Louisiana	3,685	1,452	1,296	39	35
Maine	1,017	419	351	41	35
Maryland	3,995	1,829	1,671	46	42
Massachusetts	5,766	3,598	3,147	62	55
Michigan	9,067	4,939	4,396	54	48
Minnesota	3,893	2,670	2,290	69	59
Mississippi	2,240	688	613	31	27
Missouri	4,724	2,397	2,023	51	43
Montana	713	363	315	51	44
Nebraska	1,513	975	822	64	54
Nevada	519	239	223	46	43
New Hampshire	767	358	314	47	41
New Jersey	7,320	4,700	4,102	64	56
New Mexico	1,050	412	372	39	35
New York	18,338	14,722	12,537	80	68
North Carolina	5,121	1,735	1,527	34	30
North Dakota	620	278	233	45	38
Ohio	10,768	5,152	4,479	48	42
Oklahoma	2,607	1,079	960	41	37
Oregon	2,179	1,603	1,415	74	65
Pennsylvania	11,915	7,172	6,070	60	51
Rhode Island	937	493	419	53	45
South Carolina	2,597	759	684	29	26
South Dakota	673	275	229	41	34
Tennessee	4,013	1,640	1,490	41	37
Texas	11,496	4,850	4,407	42	38
Utah	1,121	661	595	59	53

See footnotes at end of table.

Table C6.

NUMBER OF CIVILIAN DENTISTS AND DENTIST/POPULATION RATIOS, BY STATE: DECEMBER 31, 1972—Continued

State	Civilian population July 1, 1972 (in 1,000's)	Number of civilian dentists		Rate per 100,000 population	
		Total	Active	Total	Active
Vermont	462	198	176	43	38
Virginia	4,604	2,020	1,827	44	40
Washington	3,406	2,219	1,990	65	58
West Virginia	1,780	710	611	40	34
Wisconsin	4,518	2,602	2,223	58	49
Wyoming	341	175	156	51	46

Source:
Civilian dentists: BHRD, Division of Dental Health.
Population: Bureau of the Census. *Current Population Reports.* P-25, No. 488.

Note: State population figures may not add to United States due to independent rounding.

Table C7.

NUMBER OF ACTIVE PHARMACISTS, BY SEX AND BY AGE GROUP: DECEMBER 31, 1971

Sex and age group	Number of active pharmacists	Percent distribution
Both sexes	130,740	100.0
Male	118,020	90.3
Female	12,730	9.7
All ages	130,740	100.0
Less than 25 years	3,960	3.0
25-49 years	81,500	62.3
25-29	21,830	16.7
30-39	31,790	24.3
40-49	27,880	21.3
50-64 years	33,790	25.8
50-59	22,240	17.0
60-64	11,550	8.8
65 years and over	11,490	8.8
65-69	5,940	4.5
70-74	3,360	2.6
75 and over	2,180	1.7

Source: National Association of Boards of Pharmacy. 1972 Proceedings. *Licensure and Census of Pharmacy*. Chicago, The Association, 1973.

Note: Figures may not add to totals and subtotals due to independent rounding.

Table C8.

NUMBER OF ACTIVE PHARMACISTS, BY TYPE OF EMPLOYER: DECEMBER 31, 1971

Type of employer	Number of active pharmacists	Percent distribution
All types	130,740	100.0
Community pharmacy owner or partner	45,720	35.0
Community pharmacy employee	61,640	47.1
Hospital pharmacy	12,970	9.8
Manufacturing and wholesale	5,080	3.9
Teaching, government, and other	5,340	4.1

Source: National Association of Boards of Pharmacy. 1972 Proceedings. *Licensure Statistics and Census of Pharmacy.* Chicago, The Association, 1973.

Note: Figures may not add to totals due to independent rounding.

Table C9.

NUMBER OF FULL- AND PART-TIME EMPLOYEES AND BUDGETED VACANCIES IN SELECTED CATEGORIES OF PERSONNEL IN COMMUNITY HOSPITALS IN THE UNITED STATES, BY GEOGRAPHIC REGION: 1973

Occupational category	United States		Northeast		North Central		South		West	
	Total full-time and part-time employees	Total full-time and part-time budgeted positions vacant	Total full-time and part-time employees	Total full-time and part-time budgeted positions vacant	Total full-time and part-time employees	Total full-time and part-time budgeted positions vacant	Total full-time and part-time employees	Total full-time and part-time budgeted positions vacant	Total full-time and part-time employees	Total full-time and part-time budgeted positions vacant
Total hospital personnel	2,350,664	73,524	645,310	16,512	686,398	18,260	670,554	26,563	348,402	12,189
Total selected categories	535,794	21,620	113,675	4,879	167,349	5,891	175,633	8,007	79,137	2,843
Clinical laboratory technologists	46,644	2,201	11,436	439	13,881	661	11,854	927	9,473	174
Cytotechnologists and cytotechnicians	1,234	163	797	49	521	37	683	61	233	16
Histologic technicians and aides	5,739	194	1,641	31	1,530	29	1,719	95	849	39
Dietitians	9,377	479	2,350	109	2,991	142	2,485	180	1,551	48
Dietary technicians	16,102	355	3,921	49	4,430	49	5,589	178	2,162	79
Medical record librarians (administrators)	5,267	353	981	43	1,517	97	1,805	150	964	63
Medical record technicians	14,565	444	3,082	100	4,526	76	4,674	191	2,283	77
Aides, orderlies and attendants	352,825	13,171	69,375	3,249	113,509	3,687	122,302	4,606	47,639	1,629
X-ray technologists and technicians	36,819	1,466	10,248	363	10,020	292	11,051	554	5,500	217
Occupational therapists	1,972	248	437	70	686	77	378	64	471	37
Occupational therapy assistants and aides	1,477	89	237	4	714	25	310	29	316	31
Physical therapists	7,978	694	2,164	98	2,445	203	1,707	263	1,662	130
Physical therapy assistants and aides	8,146	322	1,513	22	2,969	76	2,561	134	1,103	90
Inhalation therapists and aides	26,549	1,441	5,493	253	7,610	440	8,515	535	4,931	213

Source: U.S. Department of Health, Education, and Welfare; Public Health Service; Health Resources Administration; Bureau of Health Resources Development; Division of Manpower Intelligence. *Survey of Selected Hospital Manpower February 1973. A Preliminary Report.*

Table C10.

ESTIMATED SUPPLY OF SELECTED CATEGORIES OF PUBLIC AND COMMUNITY HEALTH PERSONNEL: 1970, 1971

Category	Supply 1971	Supply with masters level training or higher 1970
Total	95,600	19,757
Environmental health, total	15,000	2,200
State & local governments	12,000	NA
Food manufacturers	3,000	NA
Epidemiology	1,000	1,000
Health education	2,000	2,000
Health services administration, total	48,000	6,500
Public health administration	5,000	NA
Hospital administration	17,000	NA
Nursing home administration	16,000	NA
Voluntary health agencies	10,000	NA
Health statistics	1,100	[1] 1,100
Maternal health, family planning, and child health	800	800
Mental health	200	200
Public health dentistry	300	300
Public health nursing	26,000	[2] 2,457
Public health nutrition	1,000	1,000
Public health veterinary medicine	200	200

[1] Data are for 1971.
[2] Data are for 1968.

Source: 1971 total supply:
Environmental health: U.S. Department of Labor. *Occupational Outlook Handbook.* 1972-73 edition. Statistics Bulletin No. 1700.
Epidemiology: estimates from American Epidemiological Society.
Health education: American Public Health Association.
Health services administration, health statistics: National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities, 1971.* DHEW Pub. No. (HSM) 72-1509. U.S. Government Printing Office, 1972.
Maternal health, family planning, and child health; mental health; public health dentistry; and public health veterinary medicine: Task Force on Professional Health Manpower for Community Health Programs, 1973 Report.
Public health nursing: estimate based on projection of January 1967 data from Third National Conference on Public Health Training.
Public health nutrition: Pennell, Maryland Y. and Hoover, David B. *Health Manpower Source Book 21. Allied Health Manpower Supply and Requirements: 1959-80.* Public Health Service Pub. No. 263, Section 21.
1970 supply with masters level training or higher: Task Force on Professional Health Manpower for Community Health Programs, 1973 Report.

Table C11.
DISTRIBUTION OF ACTIVE OPTOMETRISTS, BY SEX AND BY AGE GROUP: 1973

Sex	Percent distribution
Both sexes	100.0
Male	97.8
Female	2.2
All ages	100.0
Less than 30 years	11.3
30 - 44 years	26.7
30-34	8.7
35-39	6.8
40-44	11.2
45 - 64 years	55.3
45-49	18.8
50-54	18.4
55-59	12.0
60-64	6.2
65 years and over	6.7
65-69	3.3
70 and over	3.3

Source: Preliminary data from the National Census of Optometric Manpower Resources conducted by the American Optometric Association under contract with BHRD.

Note: Percents may not add to totals and subtotals due to independent rounding.

Table C12.
DISTRIBUTION OF ACTIVE OPTOMETRISTS, BY PRINCIPAL FORM OF EMPLOYMENT: 1973

Principal form of employment	Percent distribution
All active optometrists	100.0
Self-employed	80.2
Solo practice	64.2
Partnership	13.4
Group practice	2.6
Employed	19.8
Professional corporation	4.3
Federal Government (Armed forces, PHS)	2.6
Federal Government (other)	0.2
State and local government	0.2
Other optometrist	5.8
Ophthalmologist	0.8
Other physician	0.1
Firm or manufacturer	2.2
Nonprofit organization/institution	2.0
Multidisciplinary group practice	1.0
Other	0.5

Source: Preliminary data from the National Census of Optometric Manpower Resources conducted by the American Optometric Association under contract with BHRD.

Note: Percents may not add to totals and subtotals due to independent rounding.

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Appendix D

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I. GENERAL*

Coale, A. J. and Demeny, P. *Regional Model Life Tables and Stable Populations.* Princeton, N.J.: Princeton University Press, 1966.

Presents statistical data on life expectancy by age group.

Fullerton, Howard N. A Table of Expected Working Life for Men, 1968. *Monthly Labor Review,* Vol. 94, No. 6, pp. 49-55, June 1971.

Contains 1968 longevity estimates, and death and retirement rates for U.S. male workers at various ages, with explanation of methodology used to derive estimates and rates.

Kaplan, David L., and Casey, M. Claire. *Occupational Trends in the United States, 1900 to 1950.* Bureau of Census Working Paper No. 5. Washington, D.C.: U.S. Department of Commerce, 1958.

Presents statistical and other data on trends in various occupations in the U.S. over a 50-year period.

National Advisory Commission on Health Manpower. *Report to the President.* Washington, D.C.: U.S. Government Printing Office, 1967.

Report consists of two parts. Part I covers supply, education, and needs in health manpower and health care systems, together with recommendations for improvement and change. Part II consists of extensive, original reports of seven member panels: Consumer; Education and Supply; Federal Use of Health Manpower; Foreign Medical Graduates; Hospital Care; New Technologies; and Organization of Health Services.

National Commission on Community Health Services. *Health Manpower: Action to Meet Community Needs.* Washington, D.C.: Public Affairs Press, 1967.

Report of Task Force on Health Manpower, to National Commission on Community Health Services. Basic project (financed jointly by U.S. Public Health Service, Vocational Rehabilitation Administration, Commonwealth Fund, Kellogg Foundation, McGregor Foundation, and New York Foundation) studied community health needs, issues, and resources. Made recommendations to "achieve effective mobilization of the key resource of health manpower."

Task Force on Professional Health Manpower for Community Health Programs. (Thomas H. Hall, Coordinator.) *Professional Health Manpower for Community Health Programs, 1973.* Chapel Hill, N.C.: University of North Carolina, School of Public Health, Department of Health Administration, 1973.

Contains descriptive material on schools of public health (enrollment, graduates, programs, student characteristics, etc.); discusses emerging Federal policies in health *re.* community health manpower; presents data on present situation and future perspectives for selected categories of community health manpower; presents data on sources and methods.

U.S. Bureau of the Census. *Current Population Reports. Population Estimates and Projections.* Series P-25. Washington, D.C.: U.S. Department of Commerce. (*Seriatim.*)

Presents varying types of statistical data (including projections), on selected U.S. population by State, region, etc., based on Census reports, interpolations of Census data, surveys, etc. Reports issued as numbered separates in Series P-25.

U.S. Bureau of the Census. *Statistical Abstract of the United States, 1966.* Washington, D.C.: U.S. Government Printing Office, 1966. (Also prior and later years.)

Presents pertinent summary statistics on the U.S., based on Census data. Includes data on specific health occupations.

U.S. Bureau of the Census. *U.S. Census of Population: 1960. Detailed Characteristics. U.S. Summary.* Final Report PC(1)-1D. Washington, D.C.: U.S. Government Printing Office, 1963.

Detailed characteristics of U.S. population, based on 1960 Census—data on families, fertility, migration, employment, income, occupation, etc.

(Similar summary for 1970 Census of Population: Final Report PC(1)-D1, 1973.)

U.S. Department of Health, Education, and Welfare; Office of Education; National Center for Educational Statistics. *Projections of Educational Statistics to 1980-81, 1971 Edition.* DHEW Pub. No. (OE) 72-99. Washington, D.C.: U.S. Government Printing Office, 1972. (Also prior annual issues.)

Contains statistical data on enrollments, graduates, earned degrees, teachers, and expenditures for elementary and secondary schools and institutions of higher learning. Provides projections of statistics to 1980-81 for such schools, and appends description of methodology.

* In *General Sources,* "U.S. Government Printing Office" will be spelled out. After that, citation will be abbreviated to "U.S. GPO."

U.S. Department of Health, Education, and Welfare; Public Health Service. *Health Manpower Source Book.* PHS Pub. No. 263, *Manpower in the 1960's,* Section 18 (1964); *Location of Manpower in 8 Occupations,* Section 19 (1965); *Manpower Supply and Educational Statistics for Selected Health Occupations: 1968,* Section 20 (1969); *Nursing Personnel,* Section 2 (Revised 1969); *Allied Health Manpower, 1950-80,* Section 21 (1970). Washington, D.C.: U.S. Government Printing Office.

Contains historical and other data (including some projections) on manpower supply and educational statistics for selected health occupations: medicine, osteopathy, dentistry, optometry, podiatry, pharmacy, veterinary medicine, nursing, allied health, and others. (See also specific references below under pertinent health occupations.)

U.S. Department of Health, Education, and Welfare; Public Health Service. *Third National Conference on Public Health Training: August 16-18, 1967. Report to the Surgeon General.* PHS Pub. No. 1728. Washington, D.C.: U.S. Government Printing Office, 1967.

Presents summary data on conference, together with recommendations on modification of existing legislation *re.* trained public health personnel and the Nation's public health services.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Center for Health Statistics. *State Licensing of Health Occupations.* DHEW Pub. No. 1758. Washington, D.C.: U.S. Government Printing Office, 1968.

Discusses provisions of State licensure laws relating to health occupations in various States as of 1966, with presentation of licensure statistics. Includes discussion of composition, powers, and duties of State licensing boards, together with objectives of licensing policies and practices.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Center for Health Statistics. *Vital and Health Statistics, Series 14: Data on National Health Resources.* Washington, D.C.: U.S. Government Printing Office, beginning as PHS Pub. No. 1000 (1968) and continuing up to the present as DHEW Pub. No. (HSM) 1800's.

Contains data from surveys and studies conducted by National Center for Health Statistics and published in its *Vital and Health Statistics Series.* Series 14 presents statistics on selected demographic and professional characteristics of various health manpower occupations.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health. *Health Professions Capitation Grants, FY 72.* DHEW Pub. No. (NIH) 73-460. Washington, D.C.: U.S. Government Printing Office, 1973.

Presents statistical data on first year of capitation grants program, based on grant applications submitted by health professions schools in FY 72.

U.S. Department of Labor, Bureau of Labor Statistics. *Occupational Outlook Handbook, 1972-73 Edition.* Bulletin No. 1700. Washington, D.C.: U.S. Government Printing Office, 1973. (Also prior and later biennial issues.)

Presents current data on outlook for employment, etc. in the U.S. by occupations, including health occupations.

U.S. Department of Health, Education, and Welfare; Public Health Service; Bureau of Health Manpower. *Health Manpower Perspective: 1967.* PHS Pub. No. 1667. Washington, D.C.: U.S. Government Printing Office, 1968.

Brings together significant information on supply and needs for health manpower, education and training for health services, and Federal aid. Makes estimates to 1975 for developments in health occupations: employment, admissions, enrollments, and graduates in health professions schools, etc.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Resources Administration; Bureau of Health Resources Development. *How Health Professions Students Finance Their Education.* DHEW Pub. No. (HRA) 74-13. Washington, D.C.: U.S. Government Printing Office, 1973.

Presents results of survey to determine how students of medicine, osteopathy, dentistry, optometry, pharmacy, podiatry, and veterinary medicine financed their education during 1970-71 school year.

U.S. Department of Health, Education, and Welfare; Public Health Services; Health Resources Administration; Bureau of Health Resources Development. *Survey of Selected Hospital Manpower, February 1973: A Preliminary Report.* Washington, D.C.

Survey of full-time and part-time employees, and budgeted positions vacant in community hospitals, 1973, in the United States and regions, by selected categories of personnel.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Services and Mental Health Administration. *Report on Licensure and Related Health Personnel Credentialing.* DHEW Pub. No. (HSM) 72-11. Washington, D.C.: U.S. Government Printing Office, 1971.

Identifies major problems associated with licensure, certification, and other requirements for practice or employment of health personnel (including group activities), along with recommendations by Secretary of Health, Education, and Welfare for steps toward solution of problems so identified.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Center for Health Statistics. *Comparison of Two Methods of Constructing Abridged Life Tables by Reference to a "Standard" Table. Vital and*

Health Statistics. Data Evaluation and Methods Research. Series 2, No. 4. Washington, D.C.: U.S. Government Printing Office, 1966.

Presents comparative methods for constructing abridged life tables.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Resources Administration; National Center for Health Statistics. *Life Tables. Vital Statistics of the United States,* Vol. II, Section 5. DHEW Pub. No. (HRA) 74-1147. Rockville, Md.: NCHS, 1971. (Also prior annual issues.)

Presents current data on life tables, and methodology for construction of such tables.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Services and Mental Health Administration; National Center for Health Statistics. *Health Resources Statistics. Health Manpower and Health Facilities. 1972-73.* DHEW Pub. No. (HSM) 73-1509. Washington, D.C.: U.S. Government Printing Office, 1973. (Also prior editions.)

Presents current data on education, licensure, accreditation and certification, association membership, activity status, etc., for all health occupations. Also presents current data on health facilities and health services. Original edition published for 1965.

II. MEDICINE

(M.D.'s, D.O.'s, and Foreign Medical Graduates)

American Medical Association. *Directory of Approved Internships and Residencies, 1971-72.* Chicago: The Association, 1971. (Also prior and later issues.)

Listing of approved residencies and internships by name of institution, location, specialty, etc. Includes summary tables, special studies, requirements for certification by specialty boards, etc.

American Medical Association. *Distribution of Physicians in the U.S., 1972.* Chicago: The Association, 1973. (Also prior annual editions.)

Detailed information on physicians in U.S. in 1972, including major professional activity and specialty. Data shown for non-Federal physicians, for geographic divisions and States. Some data for counties and SMSA's.

American Medical Association, Center for Health Services Research and Development. *Profile of Medical Practice.* Chicago, Ill.: The Association, 1971, 1972, 1973 editions.

Contains annual data on physicians by age, specialty, activity, income, hours of work, productivity, etc. Also contains limited analysis, bibliography of source data, and recent publications pertaining to physician manpower issues.

American Medical Association, Council on Medical Education. *Medical Education in the United States, 1972-73.* Chicago: The Association, 1973. (Also prior annual issues.)

Annual data on enrollment, graduates, internships, and residencies, with information on new medical schools. Also includes synopses of recent studies on medical education. (Education issue of The *Journal of the American Medical Association* (*JAMA*) published annually in November. Reprinted as a separate above, with addition of statistical appendices.)

American Medical Association, Council on Medical Education. *Medical Licensure Statistics for 1972.* Chicago: The Association, September 1, 1973. (Also prior annual issues.)

Statistical review of National and State Board examinations, Federal licensing examination, and Educational Council for Foreign Medical Graduates results, for M.D.'s and D.O.'s, by State, with description of State laws affecting licensure of physicians. (Licensure issue of *JAMA* published annually in June. Reprinted as a separate, above, with addition of statistical appendices.)

American Osteopathic Association. *A Statistical Study of the Osteopathic Profession, December 31, 1967.* Chicago: The Association, 1968.

Contains statistics for 1967 on State of practice, activity, and specialty of D.O.'s.

American Osteopathic Association, Office of Education. *Educational Supplement, January 1971.* Chicago: The Association, 1971. (Also prior and later annual issues.)

Contains statistics on enrollment, etc. in osteopathic schools.

Association of American Medical Colleges. *Datagrams and Communications.* Washington, D.C.: The Association. (Issued periodically.)

Provide current descriptive statistics on applicants and students, and articles on pertinent issues such as "How Medical School Characteristics Affect Location of Physician Practice." (Reprinted from *Journal of Medical Education.*)

Blumberg, Mark S. Accelerated Programs of Medical Education. *Journal of Medical Education.* Vol. 46, No. 6, pp. 643-651, August 1971.

Defines and discusses nature of accelerated medical school programs, and compares it with that of conventional programs.

Blumberg, Mark S. *Trends and Projections of Physicians in the United States, 1967-2002.* Berkeley, Calif.: Carnegie Commission on Higher Education, 1971.

In depth analysis of trends in total supply of physicians, and projections of supply to 2002, with description of projection methodology.

Butter, Irene. Health Manpower Research: A Survey. *Inquiry.* Vol. IV, No. 4, pp. 5-41, December 1967.

Presents results of survey of growth, diversification, and distribution of health manpower over period of years in order to develop framework for health manpower research.

Butter, Irene. The Migratory Flow of Doctors to and from the United States. *Medical Care,* Vol. IX, No. 1, pp. 17-31, January-February 1971.

Estimates, based on American Medical Association data, of outflow and inflow of foreign-trained physicians in the U.S. between 1966 and 1968. Discusses migration patterns, and suggests possibility that many foreign doctors migrate several times.

Crowley, A. E. and Nicholson, H. C. Negro Enrollment in Medical Schools. *JAMA,* Vol. 210, No. 1, pp. 96-100. October 6, 1969.

Historical and current (1968-69) data on Negro medical school enrollment and graduates. Includes data on analytical studies, State of education, public *vs.* private institutions, background of students, recruitment, etc.

Datagram: Comparison of Patterns of Financing for Private and Public Medical Schools. *Journal of Medical Education*, Vol. 47, No. 7, pp. 579-583, July 1972.

Presents financial data on public and private medical schools: income, expenditures, etc.

Datagram: Federal Support of Medical School Activities, 1950-1971. *Journal of Medical Education*, Vol. 46, No. 10, pp. 906-909, October 1971.

History of Federal support to medical schools through institutional grants, student scholarships, student loans, construction grants, etc., 1950-1971.

Dickinson, F. G. and Martin, L. W. *Physician Mortality, 1949-1951*. Bulletin 103, American Medical Association, Chicago: The Association, 1956.

Presents results of study on physician mortality rates over a 2-year period. Includes data on causes of death, life-expectancy, working-life expectancy, and comparisons with white males of same ages.

Dove, D. B. Minority Enrollment in U.S. Medical Schools, 1969-70, Compared to 1968-69. *Journal of Medical Education*, Vol. 45, pp. 179-181, March 1970.

Presents figures on black, female, American Indian, Mexican-American, Oriental, Puerto Rican, and other minority medical students, 1968-70. (*Journal* presents minority data annually.)

Dubé, W. F. U.S. Medical Student Enrollments, 1968-69 through 1972-73. *Journal of Medical Education*, Vol. 48, No. 3, pp. 293-297, March 1973.

Presents statistical data on medical school enrollments for a 5-year period, through 1972-73.

Dublin, L. I. and Spiegelman, M. *The Longevity and Mortality of American Physicians, 1938-1942. JAMA*, Vol. 134, No. 15, pp. 1211-1215, August 9, 1947.

Presents statistics on life expectancy and mortality among U.S. physicians over a 4-year period.

Dublin, T. D. The Migration of Physicians to the United States. *The New England Journal of Medicine*, Vol. 286, No. 16, pp. 870-877, April 20, 1972.

Discusses immigration of foreign medical graduates to the U.S., by visa status, with reasons for the migration patterns. Also discusses problems inherent in present methods of data collection.

Ellingson, H. V. Training in Aerospace Medicine. *Aerospace Medicine*, Vol. 39, No. 9-Sect. II, pp. 1-28, September 1968.

Presents data on education and training in aerospace medicine. Report of conference held in Columbus, Ohio, September 1967, sponsored jointly by American College of Preventive Medicine, Aerospace Medical Association, and Ohio State University.

Emerson, H. and Hughes, H. E. Death Rates of Male White Physicians in the United States by Age and Cause. *American Journal of Public Health*, Vol. 16, No. 11, pp. 1088-1093, November 1926.

Presents results of study of white physician mortality in the U.S.

Fein, Rashi. *The Doctor Shortage: An Economic Diagnosis*. Washington, D.C.: The Brookings Institution, 1967.

First in series, "Studies in Social Economics," concerned with health, education, social security and welfare, supported in part by DHEW funds. Assesses "doctor shortage," projects future demand for and supply of physician services; and discusses ways of meeting problems.

Haug, J. N., and Martin, B. C. *Foreign Medical Graduates in the United States, 1970*. Chicago: American Medical Association, 1971.

Data on foreign medical graduates practicing in U.S., by country of graduation, age, sex, specialty, activity, State of practice, and other descriptive criteria. Contains narrative description and bibliography.

Haynes, M. A. Distribution of Black Physicians in the United States, 1967. *JAMA*, Vol. 210, No. 1, pp. 93-95, October 1969.

Current and historical data on Negro physicians in the United States by type of practice, State, specialty, etc.

Institute of International Education. *Open Doors, 1970. Report on International Exchange*. New York: The Institute, 1970.

Presents statistical data on enrollment of Americans in schools (including medical schools), outside the United States.

Kabara, Jon J. The Spiral Curriculum: Model for Health Science Educational Programs. *The D.O.*, Vol. 12, No. 11, pp. 105-108, July 1972.

Discusses recent developments and changes in osteopathic curriculum as model for other health science programs.

Kabara, Jon J. and Jacobson, Lawrence E. The Spiral Curriculum: For Training Osteopathic Physicians. *The D.O.*, Vol. 12, No. 11, pp. 93-101, July 1972.

Analyzes current status of training for osteopathic physicians; presents data on recent developments in curriculum modifications.

King, Haitung. Health in the Medical and Other Learned Professions. *Journal of Chronic Diseases*. Vol. 23, No. 4, pp. 257-281, April 1970.

Presents data on physician health and mortality in Great Britain and other countries; also data on other professions.

Koehler, John E. and Slighton, Robert L. *Activity Analysis and Cost Analysis in Medical Schools.* Santa Monica, Calif.: The Rand Corporation, July 1972.

Cost analysis study prepared by Rand Corporation, under contract, jointly for National Institutes of Health and the Department of Health, Education, and Welfare.

Koehler, John E. and Williams, Albert P., Jr. *Economic Implications of Changes in Financing Medical Education.* Santa Monica, Calif.: The Rand Corporation, December 1973.

Paper (19 pp.) prepared by Rand Corporation for staff use. Evaluates impact of sources of financing of medical education on growth of medical schools, particularly Federal financial support.

Kozlow, Doris A. (Ed.). The NDTI Specialty Profile. *National Disease and Therapeutic Index.* Ambler, Pa.: Lea, Inc. (now IMS America), 1972.

Published every two years. Provides profile of physicians in private practice in U.S. in terms of specialty.

Li, F. P. Working-Life Span of Physicians. *JAMA*, Vol. 206, No. 6, p. 1308, November 4, 1968.

Letter to Editor on life-expectancy of physicians at any age as compared with that of U.S. males at same age. Working-life expectancy and expected length of retirement also compared.

Margulies, Harold and Bloch, Lucille S. *Foreign Medical Graduates in the United States.* Cambridge, Mass.: Harvard University Press, 1969.

Full discussion of supply and distribution of foreign medical graduates in the U.S. Covers both foreign and U.S. born M.D.'s.

Mason, Henry R. A Profile of 314 Americans Graduating from Foreign Medical Schools. *JAMA*, Vol. 209, No. 8, pp. 1196-1199, August 25, 1969.

Presents data on Americans graduated from foreign medical schools, including data on course completion and credentialing.

Mason, Henry R. Foreign Medical Schools: Organization and Expenditures in 13 Schools Attended by More than 2,000 U.S. Students. *JAMA*, Vol. 217, No. 13, pp. 1845-1846, September 27, 1971.

Financial data on foreign medical schools in terms of basic science departments, and comparison with similar financial data in U.S. schools.

Mason, Henry R. Foreign Medical Schools as a Resource for Americans. *Journal of the National Association of College Administrative Counselors.* Vol. 5, No. 3, pp. 16-20, November 1970.

Presents data on enrollment of Americans in medical schools outside the United States.

Mason, Henry R. Manpower Needs by Specialty. *JAMA*, Vol. 219, No. 12, pp. 1621-1626, March 20, 1972.

Presents data, by medical specialty, on health manpower needs.

Pennell, Maryland Y. Statistics on Physicians, 1950-63. *Public Health Reports*, Vol. 79, No. 10, pp. 905-910, October 1964.

Article reviews history of American Medical Association's data base of M.D. population, and discusses changes in coverage and definition made in early 1960's.

Pennell, M. Y. and Renshaw, J. E. Distribution of Women Physicians, 1969. *Journal of American Medical Women's Association*, Vol. 26, No. 4, pp. 187-190, 1971.

_____. *Op. cit.*, 1970, *JAMWA*, Vol. 27, No. 4, pp. 197-203, 1972.

Articles include descriptive characteristics of women physicians in the U.S.: by State, professional activity, and primary specialty.

Rittenhouse, C. H. and Weiner, S. *A Study of the Semi-Annual Admissions System at the University of Tennessee College of Medicine.* Menlo Park, Calif.: Stanford Research Institute, March 1971.

Presents results of study of impact of shortening curriculum in medical schools.

Roback, G. A. *Distribution of Physicians in the U.S., 1972.* Vol. 1—Regional, State, County. Vol. 2—Metropolitan Areas. Chicago: American Medical Association, 1973. (Also prior annual issues under varying authorship.)

Presents detailed analysis of Federal and non-Federal physician distribution in U.S. as of 1972, together with statistical data on medical specialties and activity; hospitals and hospital beds; resident population and income.

Ruhe, C. H. W. Present Projections of Physician Production. *JAMA*, Vol. 198, No. 10, pp. 168-174, December 5, 1966.

Contains projections of physician population to 1975 (from 1965), and compares results to earlier projections.

Rusk, H. A.; Diehl, H. S.; Barclay, R. W.; and Kaetzel, P. K. The Work Week of Physicians in Private Practice. *The New England Journal of Medicine.* Vol. 249, No. 17, pp. 678-681, Oct. 22, 1953.

Discussion of physician working patterns in private practice.

Smith, Louis C. Remund and Crocker, Anna R. *How Medical Students Finance Their Education.* PHS Pub. No. 1336-1. Washington, D.C.: U.S. GPO, January 1970.

Presents data on medical and osteopathic student financing based on 1967-68 survey conducted by Public Health Service, in cooperation with Association of American Medical Colleges and American Association of Osteopathic Colleges.

Smith, Melody A. *Minorities and the Health Professions: An Annotated Bibliography*. Washington, D.C.: Association of American Medical Colleges, October 1972.

Contains annotations on more than 200 publications dealing with minority or disadvantaged groups. Designed as source of information on attitudes, characteristics, and academic and professional aspirations of minority and disadvantaged students seeking to enter the health professions.

Stevens, Rosemary. Trends in Medical Specialization in the United States. *Inquiry*, Vol. VIII, No. 1, pp. 9-19, March 1971.

Discusses past and current trends in medical specialization, proliferation of specialties, and need for manpower policy. Notes existing maldistribution of medical specialties, and prospects for the future, based on planning, numerical ceilings, etc. Alternatives suggested.

Stevens, Rosemary, and Vermeulen, Joan. *Foreign Trained Physicians and American Medicine*. DHEW Pub. No. (NIH) 73-325. Washington, D.C.: U.S. GPO, June 1972.

Presents data on immigration status, licensing, location, professional activity, etc. of foreign trained physicians in U.S.; analyzes data in terms of physician manpower and policy.

Stewart, William H. and Pennell, Maryland Y. *Health Manpower Source Book 11. Medical School Alumni*. PHS Pub. No. 263, Section 11. Washington, D.C.: U.S. GPO, 1961.

Describes distribution, type of practice, schools attended, etc. of graduates of U.S. medical schools.

Surgeon General's Consultant Group on Medical Education. *Physicians for a Growing America*. U.S. Department of Health, Education and Welfare, Public Health Service Pub. No. 709. Washington, D.C.: U.S. GPO, October 1959.

Publication known as "Bane Committee" Report. Contains history of supply of physicians from 1930, and projections to 1975. Financial aspects of medical school construction and operation, trends in student enrollment, and other variables relating to physician supply also given in historical perspective.

Theodore, C. N. and Haug, J. N. (assisted by Martin, B. C.). *Selected Characteristics of the Physician Population, 1963 and 1967*. Chicago: American Medical Association, 1968.

Compares statistical data on selected characteristics of physician population in two given years.

Theodore, C. N.; Haug, J. M.; Balfe, B. E.; Roback, G. A.; and Franz, E. J. *Reclassification of Physicians, 1968*. Chicago: American Medical Association, 1971.

Presents data on distribution of physicians, etc., by specialty, for year 1968.

Theodore, C. N.; Sutter, G. E.; and Haug, J. N. *Medical School Alumni, 1967*. Chicago: American Medical Association, 1968.

Describes distribution, type of practice, etc. of medical school alumni.

U.S. Comptroller General. *Report to the Congress: Program to Increase Graduates from Health Professions Schools and Improve the Quality of Their Education*. Washington, D.C.: U.S. General Accounting Office, 1972.

Review of programs administered by National Institutes of Health, Department of Health, Education, and Welfare.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Resources Administration; Bureau of Health Resources Development. *Medical Specialties: An Annotated Bibliography and Selected Ongoing Studies*. DHEW Pub. No. (HRA) 74-10. Washington, D.C.: U.S. GPO, August 1973.

Represents a selective listing of recent manpower studies in the major medical specialties, with brief annotations.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Manpower Education. *The Foreign Medical Graduate: A Bibliography*. DHEW Pub. No. (NIH) 73-440. Washington, D.C.: U.S. GPO, November 1972.

Bibliography, through September 1972, focuses on foreign medical graduates in U.S.: education, training, utilization, inflow and outflow, etc.

Weiskotten, H. G.; Wiggins, W. S.; Altenderfer, M. E.; Gooch, M., and Tipner, A. Trends in Medical Practice—An Analysis of the Distribution and Characteristics of Medical School Graduates, 1915-1950. *Journal of Medical Education*, Vol. 35, No. 12, pp. 1071-1121, December 1960.

Presents results of surveys of graduates of American medical colleges, over a period of selected years from 1915 through 1950. Covers age at graduation, method of practice, type of salaried position, type of practice, specialty, place of practice, graduate training, etc.

Williams, S. V.; Munford, R. S.; Colton, T.; Murphy, D. A.; and Poskanzer, D. C. Mortality Among Physicians: A Cohort Study. *Journal of Chronic Diseases*. Vol. 24, No. 6, pp. 393-401, June 1971.

Presents results of study of mortality of medical school graduates as compared with that of U.S. white male population.

III. DENTISTRY

American Association of Dental Schools. *Directory of Dental Educators, 1973-74.* Washington, D.C.: The Association, 1973.

Lists dental faculty alphabetically, and by teaching area, schools, etc. Presents summary statistics on dental schools—number of faculty, academic rank, degrees earned, Specialty Board Certification, etc.

American Dental Association, Bureau of Data Processing Services. *American Dental Directory, 1972.* Chicago: The Association, 1972.

Alphabetical listing of dentists, by city and State; geographical listing of dentists by type of practice; listing of dental schools, dental organizations and boards. Published since 1947.

American Dental Association, Bureau of Economic Research and Statistics. *Distribution of Dentists in the United States by State, Region, District and County.* Chicago: The Association, 1971. (Also prior and later issues.)

Contains data on population increase and per capita buying income by county and district, as well as dentist/population ratios. Published yearly since 1953.

American Dental Association, Bureau of Economic Research and Statistics. *Facts About States for the Dentist Seeking a Location, 1970.* Chicago: The Association, 1971. (Also prior and later issues.)

Gives necessary data on States (population, etc.) for dentists seeking to locate practice.

American Dental Association, Bureau of Economic Research and Statistics. *Facts About the Dental Market, 1971.* Chicago: The Association, 1971.

Contains dental manpower demographic data (such as number of dentists by region and State), and information on income by State, licensure by State, etc. Published annually.

American Dental Association, Bureau of Economic Research and Statistics. 1971 Survey of Dental Practice I. Introduction. *Journal of the American Dental Association,* Vol. 84, No. 1, pp. 172-177, January 1972.

_____. 1971 Survey of Dental Practice II, Income of Dentists by Location, Age and Other Factors. *Journal of the American Dental Association,* Vol. 84, No. 2, pp. 397-402, February 1972.

Surveys primarily concerned with business aspects of dental practice. Part I includes a sample questionnaire used in the survey; Part II reports on the 1970 income of dentists by age, location, and mode of employment, e.g., independent and salaried dentists.

American Dental Association, Council on Dental Education. *Annual Report on Dental Education, 1973-74.* Chicago: The Association, 1974. (Also prior annual issues.)

Directory of dental schools, including information on specific programs offered, tuition costs, and statistical data on students enrolled the previous year. Published annually since 1939. Until 1966-67, published as *Dental Students Register.*

American Dental Association, Council on Dental Education. *Annual Report on Dental Education, 1973-74. Supplement 4. Minority Report.* Chicago: The Association, 1974. (Also prior annual issues.)

Presents summary data from Annual Survey of Dental Educational Institutions. Earlier annual issues appeared under title "Minority Student Enrollment and Opportunities in U.S. Dental Schools."

American Dental Association. Council on Dental Education. *Dental Students Register, 1966-67.* Chicago: The Association, 1967. (Also prior and later annual issues.)

Directory of dental schools, including information on specific programs offered, tuition costs, and statistical data on students enrolled the previous year. Published annually since 1939. Name changed after 1966-67 to *Annual Report on Dental Education.* (See above.)

Cole, Roger B., and Cohen, Lois K. Dental Manpower. Estimating Resources and Requirements. *Milbank Memorial Fund Quarterly,* XLIX, No. 3, Part 2, pp. 29-62, July 1971.

Contains history of dentist and dental auxiliary manpower supply and requirements from 1950 to 1970, with information on demographic and income characteristics of dental patients. Also contains projections of supply and requirements to 1980, and bibliography.

Douglas, Bruce L.; Wallace, Donald A.; Lerner, Monroe; and Coopersmith, Sylvia B. Impact of Water Fluoridation on Dental Practice and Dental Manpower. *Journal of the American Dental Association,* Vol. 84, No. 2, pp. 355-367, February 1972.

Report contains results of study (using seven matched pairs of mid-Western communities as data source) on effect of fluoridation on dentists' fees, income, treatment methods, and size of patient load.

Feldstein, Paul J. *Financing Dental Care: An Economic Analysis.* Lexington, Massachusetts: D.C. Heath, Lexington Books, 1973.

Comprehensive economic framework for dental sector developed to clarify costs and benefits of alternative financing programs. Initial econometric model constructed involving supply and demand for dental services, dental manpower, and dental training facilities; and providing forecasts for several financing alternatives.

Johnson, Donald W. and Thompson, Mary B. *Compilation of State Dentist Manpower Reports, 1965-67.* U.S. Department of Health, Education, and Welfare; Public Health Service; Bureau of Health Professions Education and Manpower Training. Washington, D.C.: U.S. GPO, 1970.

Report gives State-by-State licensure procedures for December 1964-July 1967 registration periods. Contains results of Nationwide survey of dental profession conducted jointly by Federal Government, American Association of Dental Examiners, and State Licensing Boards. Compiled by Division of Dental Health.

Johnson, Donald W. and Bernstein, Stuart. Classification of States Regarding Expanded Duties for Dental Auxiliaries and Selected Aspects of Dental Licensure–1970. *American Journal of Public Health*, Vol. 62, No. 2, pp. 208-215, February 1972.

Contains State-by-State analysis of laws on licensure and duties of dental hygienists and assistants, as of 1970. Laws analyzed in terms of expanded functions for auxiliaries, licensure reciprocity, and specialty licensure.

Lotzkar, S., Johnson, D. W., and Thompson, M. D. Experimental Program in Expanded Functions for Dental Assistants: Phase 1 Base Line, and Phase 2 Training. *Journal of the American Dental Association*, Vol. 82, No. 1, pp. 101-122, January 1971.

_____. *Op. cit.:* Phase 3 Experiment with Dental Teams. *Journal of the American Dental Association*, Vol. 82, No. 5, pp. 1067-1081, May 1971.

Study conducted by Division of Dental Health, Public Health Service, to investigate fezsibility of expanding functions of chairside dental auxiliaries. Study carried out at the Dental Manpower Development Center in Louisville, Kentucky.

O'Shea, R. M. and Cohen, L. K. Toward a Sociology of Dentistry. *The Milbank Memorial Fund Quarterly*, Vol. XLIX, No. 3, Part 2, July 1971.

Contains series of articles (e.g., on aspects of dentistry in U.S., Great Britain, and Israel), dealing with institution of dentistry, and dental manpower supply and requirements, from macrosociological perspective.

IV. OPTOMETRY

American Optometric Association. *Blue Book of Optometrists*. St. Louis, Mo.: The Association, Annual issues.

Presents count of active optometrists in the United States, annually, with addresses, etc., by States.

Bernstein, Stuart. How Optometry Students Finance Their Education. *Journal of the American Optometric Association*, Vol. 43, No. 7, pp. 770-773, July 1972.

Summary of findings of survey to determine how health professions students financed their education during 1970-71 school year.

Bernstein, Stuart. Optometric Education Statistics. *Journal of the American Optometric Association*, Vol. 43, No. 8, pp. 869-872, August 1972.

Data on enrollment and graduates in schools of optometry, based on 1971 capitation grants applications received in Bureau of Health Manpower Education, National Institutes of Health.

Birchard, Clifton H. and Elliott, Theodore F. A Re-evaluation of the Ratio of Optometrists to Population in the United States in the Light of Socio-Economic Trends in Health Care. *American Journal of Optometry and Archives of American Academy of Optometry*, Jan., Feb., and March 1966 issues. Reprinted by American Optometric Association. 47 pp. St. Louis, Mo.: The Association, 1967.

Re-evaluation of desirable and optimum ratios of optometrists to population in the U.S., assuming a National health insurance plan in effect in 1980.

Heath, Gordon. The Need for New Optometry Schools. *Journal of the American Optometric Association*, Vol. 42, No. 12, pp. 1143-1150, November 1971.

Study relates optometric education to supply, and concludes that, to meet needs, doubling number of schools of optometry is realistic goal, since most existing schools are at maximum feasible capacity.

Mote, Herbert G. A Statistical Survey of Optometric Manpower Needs. *Journal of the American Optometric Association*, Vol. 40, No. 12, pp. 1201-1203, December 1969.

Analysis of optometric needs, by States, to 1980, based on population growth as estimated by Bureau of Census.

Mount, Henry S. and Hudson, Bettie L. *Optometrists Employed in Health Services, United States–1968*. DHEW Pub. No. (HSM) 73-1803. Washington, D.C.: U.S. GPO, 1973.

Statistics presented on basic demographic and professional characteristics of 20,300 optometrists licensed to practice in 1968, and employed in health services.

Myers, Raymond I. Optometric Manpower: An Analysis of the Supply. *Journal of the American Optometric Association*, Vol. 42, No. 12, pp. 1135-1139, November 1971.

Analysis of optometric demand through 1980, based on current estimates of supply of optometrists, on attrition, and on the assumption that optimum ratio of optometrists to population is 14.3 per 100,000.

Pennell, Maryland Y. and Delong, Merrill B. Optometric Education and Manpower. *Journal of the American Optometric Association*, Vol. 41, No. 11, pp. 941-956, November 1970.

Presentation of statistical information on education and distribution of optometric manpower. Trend data presented in addition to detailed analysis of recent optometry school enrollment.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Resources Administration; Bureau of Health Resources Development. *State Reports on Survey of Optometrists*. (Published *seriatim*, beginning in 1973.)

Fifty-one individual reports, (each State and District of Columbia), giving basic data collected in 1972-73 Census of Optometrists by American Optometric Association under contract for Division of Manpower Intelligence in Bureau of Health Resources Development.

Worrell, Burton E. Some Approaches to the Maldistribution of Optometric Manpower. *Journal of the American Optometric Association*, Vol. 47, No. 12, pp. 1157-1159, November 1971.

Evaluation of maldistribution of optometric manpower; reasons for maldistribution explored; and four approaches to the problem offered.

V. PHARMACY

Barker, Kenneth N., and Smith, Mickey C. Deficiencies of the Task Force Criteria for Identifying Subprofessional Tasks. *American Journal of Hospital Pharmacy*, Vol. 29, No. 9, pp. 734-742, September 1972.

Authors discuss deficiencies in one set of criteria for identifying subprofessional tasks, and propose series of field studies designed to develop comprehensive set of work category definitions to describe work of pharmacist.

Barker, Kenneth N.; Smith, Mickey C.; and Winter, Evans R. The Work of the Pharmacist and the Potential Use of Auxiliaries. *American Journal of Hospital Pharmacy*, Vol. 29, No. 1, pp. 35-53, January 1972.

Study of utilization of pharmacist's time in small hospital setting. Objective of study: determination of how much of pharmacist's time might be saved by delegation of certain tasks to auxiliaries.

Bliven, Charles W. Report of Degrees Conferred by Schools and Colleges of Pharmacy for the Academic Year 1971-72. *American Journal of Pharmaceutical Education*, Vol. 37, No. 1, pp. 126-137, February 1973. (Also prior annual reports.)

Presents current statistics on graduates from schools of pharmacy, by numbers and types of degrees conferred, by sex and race of graduates, etc. Report covers period July 1, 1971 to June 30, 1972, and includes data from all 74 active member schools in United States.

Froh, Richard B. The Up and Coming Roles of the Pharmacist. *Journal of the American Pharmaceutical Association*, Vol. NS12, No. 8, pp. 404-407, August 1972.

Article explains several categories of functions possibly involving future pharmacist. Given rapidity of change, three categories seen as minimum number of service activities for future pharmacist: (1) drug use control, (2) clinical pharmacy, and (3) physician surrogate.

Kirk, Kenneth W. and Ohvall, Richard A. Women Pharmacists in Hospital and Community Practice. *American Journal of Hospital Pharmacy*, Vol. 29, No. 9, pp. 761-766, September 1972.

Results of study of women pharmacists conducted during 1971. Report on 276 women pharmacists practicing in hospital pharmacy, and comparison with responses from 713 community women pharmacists.

National Association of Boards of Pharmacy. *1971 Proceedings. Licensure Statistics and Census of Pharmacy*. Chicago: The Association. (Also *1972 Proceedings*, published in 1973, and annual proceedings prior to 1971.)

Presents data on selected demographic and professional characteristics of pharmacists: age distribution, primary and secondary activities, place of activity, sex, education, and number of licentiates (classified by applicants, failure, reciprocity, reinstatements, and recalled licenses). All data by State.

Ohvall, R. A. and Sehgal, S. K. Practice Continuity and Longevity of Women Pharmacists. *Journal of the American Pharmaceutical Association*. Vol. NS9, No. 10, pp. 518-520, October 1969.

Presents data on women pharmacists and length of working life.

Orr, Jack E. Report on Enrollment in Schools and Colleges of Pharmacy, First Semester, Term, or Quarter, 1972-73. *American Journal of Pharmaceutical Education*, Vol. 37, No. 1, pp. 138-153, February 1973. (Also prior annual reports.)

Presents current statistics on students enrolled in schools of pharmacy, by numbers and year of study, by types of degree programs, by sex and race of students, etc. Report covers first semester, term, or quarter of academic year 1972-73, beginning in Fall 1972.

Progress Report, Pharmacy Manpower Information Project. *American Journal of Pharmaceutical Education*, Vol. 36, No. 3, pp. 396-401, August 1972.

Presents data on enrollment in pharmacy schools by sex, attrition rates, etc.

Reinhardt, George R. *Pharmacy Manpower, 1966*. PHS Pub. No. 1000-Series 14, No. 2, Washington, D.C.: U.S. GPO, 1969.

Presents data on basic demographic and professional characteristics of registered pharmacists in United States in 1966, based on about 170,000 questionnaires mailed by State Boards of Pharmacy.

Rodowskas, Christopher A., Jr. The Pending Crisis in Professional Productivity. *Journal of the American Pharmacy Association*, Vol. NS10, pp. 196-199, April 1970.

Study presents demand/productivity profile of community pharmacy in 1978, forecast from trend data through 1968. Alternative delivery system proposed in light of impending shortage of professionally-trained pharmacists.

Rodowskas, Christopher A., Jr. and Dickson, W. Michael. *A Task Analysis of the Community Pharmacist*. Pharmacy Manpower Information Project. Feasibility Phase Report-1, Pub. No. 1014; Report-2, Pub. No. 1015. Silver Spring, Md.: The Association, April 1973.

Report made under contract with U.S. Department of Health, Education, and Welfare, National Institutes of Health, Bureau of Health Manpower Education, Division of Manpower Intelligence, by American Association of Colleges of Pharmacy.

Report-1 presents task analysis involving identification of activities for selected group of community pharmacists practicing in specified work setting. In-depth description of utilization of pharmacists in chain pharmacy population obtained by combining data on all variables in investigation.

Report-2 examines current status and future supply of, and requirements for, pharmacy manpower, with consideration given to alternative delivery systems for more effective utilization of professional pharmacist.

Rodowskas, Christopher A., Jr. and Gagnon, Jean P. Personnel Activities in Prescription Department of Community Pharmacies. *Journal of the American Pharmaceutical Association.* Vol. NS12, No. 8, pp. 407-411, August 1972.

Study examines prescription department work activities in relation to total prescription department income, and relates productivity to demand for services.

Nash, Rosalia H.; Dickson, W. Michael; and Rodowskas, Christopher A., Jr. Women in the Professional Work Force. *Journal of the American Pharmaceutical Association,* Vol. NS13, No. 11, pp. 622-624, November 1973.

Based on presentation before American Pharmaceutical Association, Academy of General Practice in Houston, Texas, April 24, 1972. Concerned with career patterns of professional women in work force, with emphasis on women in pharmacy.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Resources Administration; Bureau of Health Resources Development. *State Reports on Survey of Pharmacists.* (Published *seriation,* beginning in 1973.)

Fifty-one individual reports, (each State and District of Columbia), giving basic data collected in 1972-73 survey of all licensed pharmacists in United States, conducted by American Association of Colleges of Pharmacy under contract for Division of Manpower Intelligence in Bureau of Health Resources Development.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Services and Mental Health Administration; National Center for Health Services Research and Development. *Challenge to Pharmacy in the 1970's. Proceedings of Invitational Conference on Pharmacy Manpower.* DHEW Pub. No. (HSM) 72-3000. Washington, D.C.: U.S. GPO, 1971.

Proceedings of conference held by DHEW (HSMHA) jointly with School of Pharmacy, University of California, San Francisco.

Conference topics included: (1) Future role of pharmacists in a system of comprehensive health care; (2) Interrelationships between medical education and pharmacy education; (3) Pharmacist/physician relationships; (4) Need of study and research; (a) role for pharmacist, (b) models for delivery, (c) innovation in pharmacy education, and (d) models for interdisciplinary programs.

VI. PODIATRY

Bernstein, Stuart. Revised Data on Enrollment and Graduates. *Journal of Podiatric Education*, Vol. 3, No. 2, pp. 35-36, June 1972.

Update of data on enrollment and graduates in colleges of podiatry, based on 1971 capitation grants applications received in Bureau of Health Manpower Education, National Institutes of Health.

Blauch, Lloyd E. 1964 Survey of the Podiatry Profession. (Reprint No. 1:66:01, pp. 7-40. *Journal of the American Podiatry Association.*) Washington, D.C.: The Association, 1965.

Presents data on selected demographic and professional characteristics of registered podiatrists from *1964 Survey of the Podiatry Profession by the Special Studies Division, American Podiatry Association.*

Blauch, Lloyd E. *The Podiatry Curriculum.* Washington, D.C.: American Association of Colleges of Podiatric Medicine, 1970.

In-depth review of curriculum of podiatry colleges, undertaken to develop model program of instruction in podiatry, based on requirements of modern podiatric service. Report suggests series of guidelines for profession's educational institutions.

Gilbert, Arthur C. F. Report of the 1964 Survey of the Podiatry Profession. (Reprint No. 1:66:01, pp. 3-6, *Journal of the American Podiatry Association.*) Washington, D.C.: The Association, 1965.

Presents summary data on responses to questionnaire used in 1964 Survey of all known registered podiatrists as of April 15, 1964 by the Special Studies Division, American Podiatry Association.

Koch, Hugo K. and Phillips, Hazel M. *Podiatry Manpower: A General Profile, United States - 1970.* DHEW Pub. No. (HRA) 74-1805. Washington, D.C.: U.S. GPO, 1973.

Presents statistical data on podiatrists in the United States in 1970, by geographic distribution, selected characteristics, scope of activity, etc.

Levine, Jerome I. 1967 Survey of the Podiatry Profession as Related to the Use of X-Rays. *Journal of the American Podiatry Association*, Vol. 58, No. 2, pp. 64-67, February 1968.

Results of survey conducted by APA in March 1967. Survey included questions on podiatrist practices in general, and specific questions on use of radiation.

Pennell, Maryland Y. Podiatric Education and Manpower. *Journal of Podiatric Education*, Vol. 1, No. 2, pp. 11-21, June 1970.

Educational data presented for years 1960-61, through 1969-70, together with manpower statistics on supply (current and projected), and need for podiatrists estimated for 1980.

Weppecht, Kenneth R. and Baima, John A. Podiatric Practice in the United States—1969. *Journal of the American Podiatry Association*, Vol. 61, No. 2, pp. 37-43, February 1971.

Results of survey conducted by Armour Pharmaceutical Company to determine way in which today's podiatrist practices his profession: (1) conditions he treats; (2) his usage of drugs; (3) surgical procedures he performs; and (4) podiatric services he renders to his patients.

VII. VETERINARY MEDICINE

American Veterinary Medical Association, Department of Membership Services. *AVMA Directory 1972.* Chicago: The Association, 1972 (Biennial).

Directory lists AVMA members in the U.S., Canada and other countries, and certain non-members. Statistics reflect data on AVMA members, and a limited number of nonmembers who responded to questionnaire.

Armistead, W. W. Veterinary College Organization and Curriculum: A Look at Alternatives. *Journal of the American Veterinary Medical Association,* Vol. 156, No. 15, pp. 1911-1916, June 15, 1970.

Presents an analysis of impediments to changes needed in the veterinary curriculum, and offers methods of overcoming obstacles.

Dorn, C. Richard. Veterinary Medical Services: Utilization by Dog and Cat Owners. *Journal of the American Veterinary Medical Association,* Vol. 156, No. 1, pp. 321-327, February 1, 1970.

Examines several independent pet population studies, conducted in specific U.S. areas, for factors relating to dog and cat ownership and to use of veterinary services.

Joint Committee on Education, American Veterinary Medical Association and Association of American Veterinary Medical Colleges, Inc. *Veterinary Medicine, Its Requirements and Responsibilities.* Chicago: Joint Committee, May 1973. (Also earlier issues, published periodically.)

Contribution of veterinarians to Nation's health and welfare examined. Requirements for veterinary services discussed and related to present scope of profession's practice. February 1971 issue entitled "Veterinary Medicine, Its Requirements and Responsibilities in Relation to Public Health."

May, William O., Jr.; Blenden, Donald C.; and McCulloch, William F. Public Health Aspects of Small Animal Veterinary Medical Practice. A Time-Function Study. *HSMA Health Reports,* Vol. 86, No. 10, pp. 910-914, October 1971.

Presents results of time-function study of practice time devoted to five categories of activities by "small animal" veterinarians in Missouri.

National Research Council, Committee on Veterinary Medical Research and Education. *New Horizons for Veterinary Medicine.* Washington, D.C.: National Academy of Science, 1972.

Study concerned with (1) examining and evaluating veterinary medical research and education; (2) assessing manpower and facilities; (3) gauging National needs; and (4) formulating recommendations on how resources in veterinary medical research and education can be modified and developed to meet expected needs for veterinary manpower.

Schnurrenberger, Paul R.; Martin, Russell J.; and Walker, James F. Characteristics of Veterinarians in Illinois. *Journal of the American Veterinary Medical Association,* Vol. 160, No. 11, pp. 1512-1521, June 1, 1972.

Effort to secure high survey response rate by veterinarians in Illinois in 1967 resulted in 99% response. Follow-up interviews conducted in 1968 and 1969.

Student Enrollment, 1972-73; Residence of First-Year Students. *Journal of the American Veterinary Medical Association,* Vol. 163, No. 1, pp. 36-37, July 1, 1973. (Also prior annual issues.)

Presents annual statistical data on veterinary medical schools and students.

Altman, Stuart H. Alternative Measures of the Regional Availability of Nursing Manpower. *Economic and Business Bulletin*, Vol. 24, No. 1, pp. 68-75, Fall 1971.

Analysis of measures of adequacy of hospital nursing personnel and demand for nursing services on a regional basis.

Altman, Stuart H. *Present and Future Supply of Registered Nurses.* DHEW Pub. No. (NIH) 72-134, November 1971. (Reprinted August 1972 as Pub. No. (NIH) 73-134.) Washington, D.C.: U.S. GPO.

Comprehensive analysis of impact of economic factors on present nurse supply and projected supply through the 1970's. Study also examines non-economic factors influencing individual's decision in such matters as choice of nursing career, type of educational program, and continued professional practice.

American Nurses' Association. *Facts About Nursing, A Statistical Summary.* 1970-71 edition. New York: The Association, 1971. (Also prior and later editions)

Beginning with the first edition in 1935, *Facts About Nursing* makes available, from various sources, statistical data on nursing. Presents information on (1) distribution of registered nurses; (2) nursing education; (3) economic status of registered nurses; (4) allied nursing personnel; (5) related information; and (6) functions and purpose of nursing organizations.

Cleland, Virginia; Bellinger, Arnold; Shea, Fredericka; and McLain, Sister Rosemary. Decision to Reactivate Nursing Career. *Nursing Research*, Vol. 19, No. 5, pp. 446-452, September-October 1970.

Article examines factors influencing decision of married nurses to reactivate their nursing careers, in order to improve prediction on future employment patterns of married nurses.

Folk, Hugh and Yett, Donald E. Methods of Estimating Occupational Attrition. *Western Economic Journal*, Vol. VI, No. 4, pp. 297-302, September 1968.

Discusses various projection methods for estimating supply of personnel in fields of engineering and nursing.

Knopf, Lucille. *From Student to RN—A Report of the Nurse Career-Pattern Study.* DHEW Pub. No. (NIH) 72-130. Washington, D.C.: U.S. GPO, 1972.

Study, initiated in 1962, presents data on biographical characteristics of nursing students, occupational goals, and reasons for choice of nursing as career. Study also examines relation of these variables to students' completion of nursing program, and subsequent work in nursing field.

Levine, Eugene. Nurse Manpower: Yesterday, Today, and Tomorrow. *American Journal of Nursing*, Vol. 69, No. 2, pp. 290-296, February 1969.

Examines characteristics of nurse manpower in early 1950's; factors influencing nursing since that time; and future expectations of nursing profession.

Marram, Gwen D. An Untapped Source of Registered Nurses. *Nursing Outlook*, Vol. 17, No. 7, pp. 48-50, July 1969.

Examines sizable fraction of potential nursing manpower in U.S. consisting of nurses who received their professional education in foreign countries, and are not eligible for registration and licensure. Suggests provision of specialized courses, with State or Federal funds or both, to enable them to qualify.

Marshall, Eleanor D. and Moses, Evelyn B. *LPN's 1967: An Inventory of Licensed Practical Nurses.* Washington, D.C.: U.S. GPO, 1971.

Report of survey made under contract with American Nurses' Association for Division of Nursing, Bureau of Health Manpower Education, National Institutes of Health, Public Health Service. Contains data on socio-demographic and employment characteristics of licensed practical nurses.

Marshall, Eleanor D. and Moses, Evelyn B. *RN's 1966 . . . An Inventory of Registered Nurses.* New York: American Nurses' Association, 1969.

Inventory of registered nurse manpower data, giving national data on personal characteristics of all registered nurses, and measuring Nation's inactive registered nurse complement.

Meyer, Burton. Development of a Method for Determining Estimates of Professional Nurse Needs. *Nursing Research*, Vol. 6, No. 1, pp. 24-28, June 1957.

Discusses formula for estimating professional nurse supply from attrition rates, etc.

National League for Nursing. *Nurse-Faculty Census.* New York: The League, 1972. (Also prior biennial editions.)

Presents statistical data, including count, on nurse-faculty personnel every 2 years.

National League for Nursing, Division of Research. *State-Approved Schools of Nursing—LPN/LVN, 1972.* New York: The League, 1972. (Also prior and later annual editions.)

Directory of State-approved schools for licensed practical nurses and licensed vocational nurses. Includes data on admissions, enrollments, graduates, etc.

National League for Nursing, Division of Research. *State-Approved Schools of Nursing—RN, 1972.* New York: The League, 1972. (Also prior and later annual editions.)

Directory of State-approved schools for registered nurses. Includes data on admissions, enrollments, graduates, etc.

Niles, Anne M. Recruiting Inactive Nurses. *Hospitals*, Vol. 44, No. 17, pp. 86-89, September 1, 1970.

Article discusses efforts to recruit inactive nurses back into professional practice, taking into account reasons for professional inactivity, and expectations.

Reese, Dorothy E.; Siegel, Stanley E.; and Testoff, Arthur. The Inactive Nurse. *American Journal of Nursing*, Vol. 64, No. 11, pp. 124-128, November 1964.

Presents results of a 1961 study of inactive nurses—plans to return to active practice, type of active practice (i.e. part or full time), etc.

Shetland, Margaret L. An Approach to Role Expansion—The Elaborate Network. *American Journal of Public Health*, Vol. 61, No. 10, pp. 1959-1964, October 1971.

Explores role of nurse, as responsibility in health care expands into decision-making, etc. to meet changing health needs of Nation and to fulfill "role expectations," as seen by both nurses and physicians.

U.S. Department of Health, Education, and Welfare. *Progress Report on Nurse Training, 1970: Report to the President and the Congress.* Washington, D.C.: U.S. GPO, 1970.

Presents report by Secretary, DHEW, on administration of Nurse Training Act of 1964, including amendments of Health Manpower Act of 1968, Title II, "Nurse Training," as incorporated into Title VIII of Public Health Service Act.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Resources Administration; Bureau of Health Resources Development. *A Directory of Programs Preparing Registered Nurses for Expanded Roles 1973-74.* DHEW Pub. No. (HRA) 74-31. Washington, D.C.: U.S. GPO, 1974.

Contains listing of two types of expanded-role training programs for registered nurses: certificate and master's degree; by institution. Includes data on area of concentration, entrance requirements, length of program, type of financial aid, etc.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Manpower Education. *Planning for Nursing Needs and Resources.* DHEW Pub. No. (NIH) 72-87. Washington, D.C.: U.S. GPO, 1972.

Presents basic guidelines, including principles and procedures, to meet changing conditions in nursing.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Professions Education and Manpower Training. *Health Manpower Source Book 2, Nursing Personnel.* PHS Pub. No. 263, Section 2. Washington, D.C.: U.S. GPO, (revised 1969).

Presents data on nurses in States and Nation as of 1966. Revision reflects: (1) distribution, characteristics, national estimates, and educational preparation of RN's; (2) nursing education; (3) practical nurses' characteristics and education; (4) RN's, LPN's, aides, orderlies, and attendants in hospitals; (5) RN's in public health and occupational health; and (6) projection of RN need and supply.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Professions Education and Manpower Training. *Nurses in Public Health, January 1968.* PHS Pub. No. 785. Washington, D.C.: U.S. GPO, revised 1969.

Report of census of nurses employed in public health conducted in 1968 by Division of Nursing.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Professions Education and Manpower Training. *Nursing Personnel in Hospitals—1968.* Washington, D.C.: U.S. GPO, May 1970.

Report contains data from 1968 survey conducted jointly by the U.S. Public Health Service and American Hospital Association. Survey estimates 445,000 RN's and 815,000 LPN's employed in hospitals in the U.S. in 1968.

IX. ALLIED HEALTH

American Medical Association, Department of Allied Medical Professions and Services. *Educational Programs for the Physician's Assistant.* Chicago: The Association, Fall 1973. (Published semi-annually.)

Presents current list of approved educational programs for allied medical professions and services, with detailed data on physician's assistant programs.

American Medical Association, Department of Health Manpower. *1972 Survey of Operational "Physician's Assistant" Programs: Numbers Graduated and Employed.* Chicago: The Association, 1972. (Mimeo, 7 pp.)

Contains listing and analysis of number of physician's assistants graduated, employment status, and place of employment.

Coordinated Health Survey Committee. *Virginia Health Manpower, 1971.* Richmond: The Committee, 1971.

Contains information on professional and technical health manpower employment and needs, by type of employer, for State and planning districts. Health manpower educational statistics also presented. Survey report compiled by Comprehensive Health Planning, Virginia Council on Health and Medical Care, and Virginia Regional Medical Program.

Dentistry in National Health Programs—A Report with Recommendations. *Journal of the American Dental Association,* Vol. 83, No. 3, pp. 569-600, September 1971.

Report of Task Force on National Health Programs of the American Dental Association. Provides summary of Nation's situation re. dental care. Projects supply and demand for dental occupations, and proposes needed dental school and dental auxiliary program expansion. Discusses demand under varying assumptions, such as: increased productivity, redistribution of personnel, increased utilization of auxiliaries, national dental insurance.

Employment Security Commission of North Carolina. *Health Manpower Needs in North Carolina, 1967-1973.* Raleigh: The Commission, 1967.

Contains information on National health manpower trends, State employment trends in surveyed facilities, and State trends by occupation. Survey conducted by Commission's Bureau of Employment Research, with cooperation of the U.S. Department of Labor's Bureau of Employment Security and the N.C. State Board of Education, Department of Community Colleges.

Hooper, Mary Evans. *Associate Degrees and Other Formal Awards Below the Baccalaureate, 1969-70.* DHEW Pub. No. (OE) 72-48. Washington, D.C.: U.S. GPO, 1971.

Contains trend data from 1965 on with respect to total awards and total enrollment in 2-year educational institutions.

Jantzen, Alice C. Some Characteristics of Female Occupational Therapists, 1970. *American Journal of Occupational Therapy,* Vol. 26, No. 1, pp. 19-26, January 1972.

Contains summary and analysis of socio-demographic and employment characteristics of female occupational therapists.

Losee, Garrie J. and Altenderfer, Marion E. *Health Manpower in Hospitals.* Washington, D.C.: U.S. GPO, 1970.

Contains estimates for 1969 of number of personnel employed, number of budgeted positions vacant, and number of additional positions needed to provide optimal care in hospitals, by occupation.

National Committee for Careers in the Medical Laboratory, Inc. Salary Survey. *GIST,* No. 50, February 1972. Bethesda, Md.: The Committee, (Newsletter.)

Contains survey information on salary, education, and place of employment of laboratory workers.

Office of Comprehensive Health Planning. *Allied Health Manpower in Texas, 1970.* Austin: The Governor's Office, 1970.

Contains detailed information on allied health manpower employment and needs, by type of employer, for State planning regions, and counties. Allied health manpower educational statistics also presented. Survey report compiled by Texas Health Careers Program and Governor's Office.

Pennell, Maryland Y. and Hoover, David B. *Health Manpower Source Book 21. Allied Health Manpower Supply and Requirements: 1950-80.* PHS Pub. No. 263, Section 21. Washington, D.C.: U.S. GPO, 1970.

Contains supply and requirements estimates, and projections to 1980, for medical, dental, nursing, environmental, and allied health manpower.

U.S. Department of Health, Education, and Welfare; Public Health Service; Health Resources Administration; Bureau of Health Resources Development. *A Directory of Programs Training Physician Support Personnel, 1973-74.* DHEW Pub. No. (HRA) 74-318. Washington, D.C.: U.S. GPO, 1974.

Contains listing of physician's assistant training programs by State and institution. Includes entrance requirements, length of training, date classes begin, class capacity, credentials awarded, and financial aid available.

Prepared jointly by Division of Medical Practice, AMA, and Division of Manpower Intelligence, BHRD, HRA, as an update of DHEW Pub. No. (NIH) 73-318, entitled "A Summary of

Training Programs—Physician Support Personnel, September 1972."

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Manpower Education. *Certification in Allied Health Professions—1971 Conference Proceedings.* DHEW Pub. No. (NIH) 73-246. Washington, D.C.: U.S. GPO, 1972.

Presents conference plan, resource papers by various allied health professional associations, recommendations, list of participants, selected references, etc.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health, Bureau of Health Manpower Education. *Physician Support Personnel: Selected Training Programs.* DHEW Pub. No. (NIH) 72-183. Washington, D.C.: U.S. GPO. (Revised May 1972.)

Presents results of survey made in April 1971 of training programs for all types of physician support personnel: Physician's Assistant, Pediatric Nurse Practitioner, Community Health Medic, etc. Contains summary tables.

U.S. Department of Health, Education, and Welfare; Public Health Service; National Institutes of Health; Bureau of Health Manpower Education. *Program Support for Physician's Assistants in Primary Care.* Bethesda, Md.: March 1972.

Brochure issued by Office of Special Programs giving program guidelines, scope of program, definitions, educational standards, financial support, etc.

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